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KRONPRINZ WILHELM ARRIVES.

The Kronprinz Wilhelm of the North German Lloyd line has just completed her initial trip to this country. She was built for the avowed intention of eclipsing the Deutschland of the Hamburg-American line, and while she made no effort to obtain a record on her initial trip, her recent performance on her trial trip shows that she is a dangerous antagonist. The career of the Kronprinz Wilhelm will be watched with interest during the next few months.

The Kronprinz Wilhelm is not quite so large as the Deutschland, the difference in length being in the engine room. Practically the only change made in the engines, as compared with those of the Deutschland, is in the arrangement of the valve-gear for the tandem engines. In the Deutschland a high-pressure cylinder is placed over each of the two low-pressure cylinders, and the piston valve of the high-pressure cylinder is actuated by means of a rocking lever pivoted on the cover of the low-pressure cylinder, and operated by separate links and eccentrics. In the new ship, however, the spindle of the high-pressure cylinder, still working on a lever pivoted to the cover of the low-pressure cylinder, is connected to the top of the spindle of the slide valves of the low-pressure cylinder, so that the one pair of eccentrics, with their gear, suffices for both low-pressure and high-pressure cylinders. The first intermediate cylinder is at the forward end of the engine, and the second intermediate at the after end, the four cranks and the reciprocating parts being balanced on the Schlick system. The two high-pressure cylinders are 870 millimeters (34.2 in.) in diameter, the intermediate cylinders being 1,750 millimeters (68.8 in.) and 2,500 millimeters (98.4 in.), while the two low-pressure cylinders are 2,600 millimeters (102.3 in.), the stroke being 1,800 millimeters (70.8 in.) The engines are to run normally at eighty revolutions, although eighty-three or eighty-four can easily be obtained. The normal indicated horse power, which has already been developed on trial with a comparatively early cut-off, is 33,000. The speed attained on the trial, 23.34 knots, gives every promise of an interesting competition with the Deutschland, whose record speed is 23.51 knots. The crank shaft of the Kronprinz Wilhelm is 610 millimeters (24 in.) in diameter, the thrust shaft 600 millimeters (23.6 in.), the tunnel shaft 580 millimeters (22.8 in.), and the propeller shaft 630 millimeters (24.8 in.), while the four-bladed propellers, of bronze, are 6,650 millimeters (21 ft. 10 in.) in diameter, and of 10 meters (32 ft. 9 in.) pitch. To enable the screw shaft to be withdrawn from the outside of the hull, a large flat coupling has been fitted to the propeller shaft, the weight of the coupling being about 11 tons. All the pumps are separate from the main engines, as well as the condenser, which latter has a length of 2,604 millimeters (8 ft. 7 in.), with 1,910 square meters (20,559 sq. ft.) of surface; this being, of course, the measurement of both the main condensers, while the auxiliary condensers are 1,600 millimeters (63 in.) long with 60 square meters (646 square meters) of surface. There are twelve double-ended and four single-ended boilers, and these, unlike those of the Deutschland, where Howden's system is in use, are to be worked under natural draft with an open stokehold, as was the case with the Kaiser Wilhelm der Grosse. The boilers, which work to a pressure of 213 lbs. per square inch, are 5,100 millimeters (16 ft. 9 in.) in diameter, the length being 6,300 millimeters (20 ft. 8 in.) in the case of the double-ended boilers, each of which has eight furnaces of 1,150 millimeters (45 in.) in diameter. The weight of the double-ended boilers is 104 tons. The total heating surface is 8,720 square meters (93,865 sq. ft.), the grate area being 251.16 square meters (2,702 sq. ft.) The boilers are arranged in four batteries, each with a funnel whose height above the firebars is 110 ft., the diameter being 4½ meters (14 ft. 9 in.) There are bunkers on each side of the boiler compartments, but the principal one is between the second and third boiler room, an arrangement which not only precludes the possibility of more than one-half of the boiler power being put out of action by a ship colliding at the point of connection between the bulkhead and shell-plating, but it confers the still greater advantage of enabling the central part of the ship to be given up to dining-room and other passenger accommodation.

As to the other machinery in the ship, it may be said that there are three electric generating sets, and two of Linde's refrigerating machines placed at the forward end of the shaft tunnel, with a fourth dynamo of 800 amperes well above the water line. An interesting change has been made in connection with the steering gear. As in former ships, this gear is of the Brown type, by Messrs. Brown Bros. of Edinburgh; but in this case the gear has been entirely duplicated; thus, while, as formerly, there is a steering installation under the water line, the rudder post is carried right up to the poop, where duplicate engine and gear are fitted, which run idle under normal conditions but will do the work should the under-water gear become dislocated or injured. Although such gear is made of great strength, there is always the possibility of a breakdown; and it seems doubtful if hand wheels, or the light emergency gear sometimes fitted, is sufficient for vessels of such high speed and great displacement. Strength and reliability are also the characteristics of windlass and capstan gear, which is by Napier Bros. of Glasgow. The forward gear consists of two cable holders, suitable for cables of 74 millimeters (2 15-16 in.) in diameter, with their brakes and coupling bosses fitted on the forecastle deck. Above the cable holders are drums for heavy warping purposes, and forward of the windlass on the forecastle deck are placed two quick-speed capstans for lighter work, which can also be worked by hand. There are two engines of great power, with cylinders 17 in. in diameter by 13 in. stroke, and 15 in. diameter by 12 in. stroke, each capable of doing all the work; and the wheel gearing is of cast steel and the worm wheels of gunmetal. A light warping capstan is fitted forward in the bow, on the forecastle head, with engines having cylinders 11 in. in diameter by 10 in. stroke, and on the promenade deck aft are fitted three warping capstans, each driven by one independent steam engine, one having cylinders 15 in. in diameter by 12 in. stroke, and fitted with a cable wheel for working the stream cable and stern anchor; the other two engines having cylinders 11 in. in diameter by 10 in. stroke.

The vessel is 663 ft. long, 66 ft. beam, with a depth (molded) of 43 ft., but there are three decks above this, the total gross tonnage being about 15,000 tons, and the normal displacement 21,300 tons, including 4,400 tons of coal and 5,250 tons of cargo. The total number of passengers is 1,651, including 650 first and 350 second-class passengers, while the crew number 520, including sixty-nine deck hands, 241 in the engine-room staff, fifty-four in the kitchen department, with 150 stewards and four postal officials.

In the equipment of the ship there are several interesting developments to which reference should be made as an indication of the conveniences and comfort provided for the present-day travelers. In the first place there is a telephonic system, including not only the public rooms and official departments, even to the wine cellars, but also many of the private rooms; and arrangements are provided so that the ship system may be coupled up to any land trunk lines—i. e., at ports of call. A messenger boy service, with electric call-instruments, is also provided. The chief steward has an exceptionally large office, centrally situated, and equipped with all the conveniences of hotel bureaux. Electric punkahs are provided in the public rooms. The electric call-bells, as well as the light switches, are arranged in the cabins, so that the passenger may operate them while in bed—not a usual convenience. The ship's clocks are electrically controlled. The look-out man in the crow's nest on the foremast can ascend to his position by a ladder inside the mast instead of outside; and there is a speaking-tube down to the navigating officer's bridge. In the matter of safety, also, the ship marks progress. Only in the bulkheads in the machinery section are there doors below the water line, and in all cases an hydraulic system is installed which is so controlled electrically that the captain on the bridge or in his cabin, or officers from various positions in the ship, may instantly close every door. To combat fire, a special pump of a capacity of 20 tons per hour is fitted, with a special system of piping throughout the ship, in which pressure is always maintained, and at many stations throughout the vessel there are special alarms, with the usual glass face; and such alarms not only communicate the fact of an outbreak to the various officers' and firemen's quarters, but also set the pump at work. These and many other ingenious details, combined with the simple yet highly artistic decoration of the public rooms, mark the Kronprinz Wilhelm as a great triumph in the ship building art.

LAKE SHIP YARD MATTERS.

Orders with the American Ship Building Co. for new steel freighters are not stopping with what the yards can do up to the opening of navigation next spring. A steamer recently ordered by G. A. Tomlinson of Duluth is not to be delivered until June next. This vessel is to be a duplicate of the steamer ordered some time ago by Mr. Tomlinson—4,800 gross tons capacity and to cost approximately $225,000. She is to be built at West Superior. Another order for a freighter to come out late next season is also expected from the Western Transit Co. of Buffalo. That company is figuring upon the construction at the Union works, Buffalo, of a package freighter to be a duplicate of their steamer Chicago, launched this week. The Chicago is 343 ft. over all, 325 ft. keel, 44 ft. beam and 28 ft. deep. She will have quadruple-expansion engines with cylinders of 19, 27½, 40 and 58 in. diameter, with 40-in. stroke. Steam will be furnished by three Scotch boilers, 11½ ft. in diameter, and 11½ ft. long, to be allowed 210 lbs. pressure.

The fact that Mr. Tomlinson, who is a son-in-law of Capt. James Davidson of West Bay City, has placed orders with the ship building combination for two steel steamers gives rise to the opinion that probably Capt. Davidson is not very earnest in his scheme for the erection at Buffalo or Erie of a plant for the construction of steel ships. He has taken no definite steps in that direction but he says that his interest in the new Tomlinson boats is not very large. The principal stockholders aside from Mr. Tomlinson, Capt. Davidson says, are Manitoba grain merchants. Capt. Davidson does not talk encouragingly regarding the future of steel vessels in the hands of the so-called individual owners, but he is not offering to sell any of his own wooden vessels. He has a fleet of about fifteen very good wooden boats, but contrary to his policy in the past is not now making prices on any of them. He says the best policy is to remain in the vessel business through good and bad times, and that is why he is not disposed to sell any of his wooden fleet.

The launch of the ocean-going steamer Hugoma (Canadian canal dimensions), building at the Wyandotte works of the Detroit Ship Building Co., will occur on Wednesday of next week. It is announced that the extensive cabin work on the two big side-wheelers that are to inaugurate a passenger and freight service between Detroit and Buffalo, and which are also building at Wyandotte, is so well advanced that it will go on in a surprising manner after the hulls are launched. Oct. 25 is the date fixed for the launching of the first of these hulls.

The Craig Ship Building Co. of Toledo is to build another steel freight and passenger steamer for the Booth Packing Co., for whom they built the Argo last winter. The Argo was not found equal to the growing business of the Booth company at the head of Lake Superior. The new vessel will have space for only about 200 tons of freight, but will have some ninety staterooms, which is much in excess of the passenger capacity of the Argo.

It is reported from Pittsburg that the American Bridge Co. has secured an option on 40 acres of land at West Homestead, as a site for the erection of the largest structural and bridge plant in the world. The land fronts on the Monongahela river and has excellent railroad facilities.

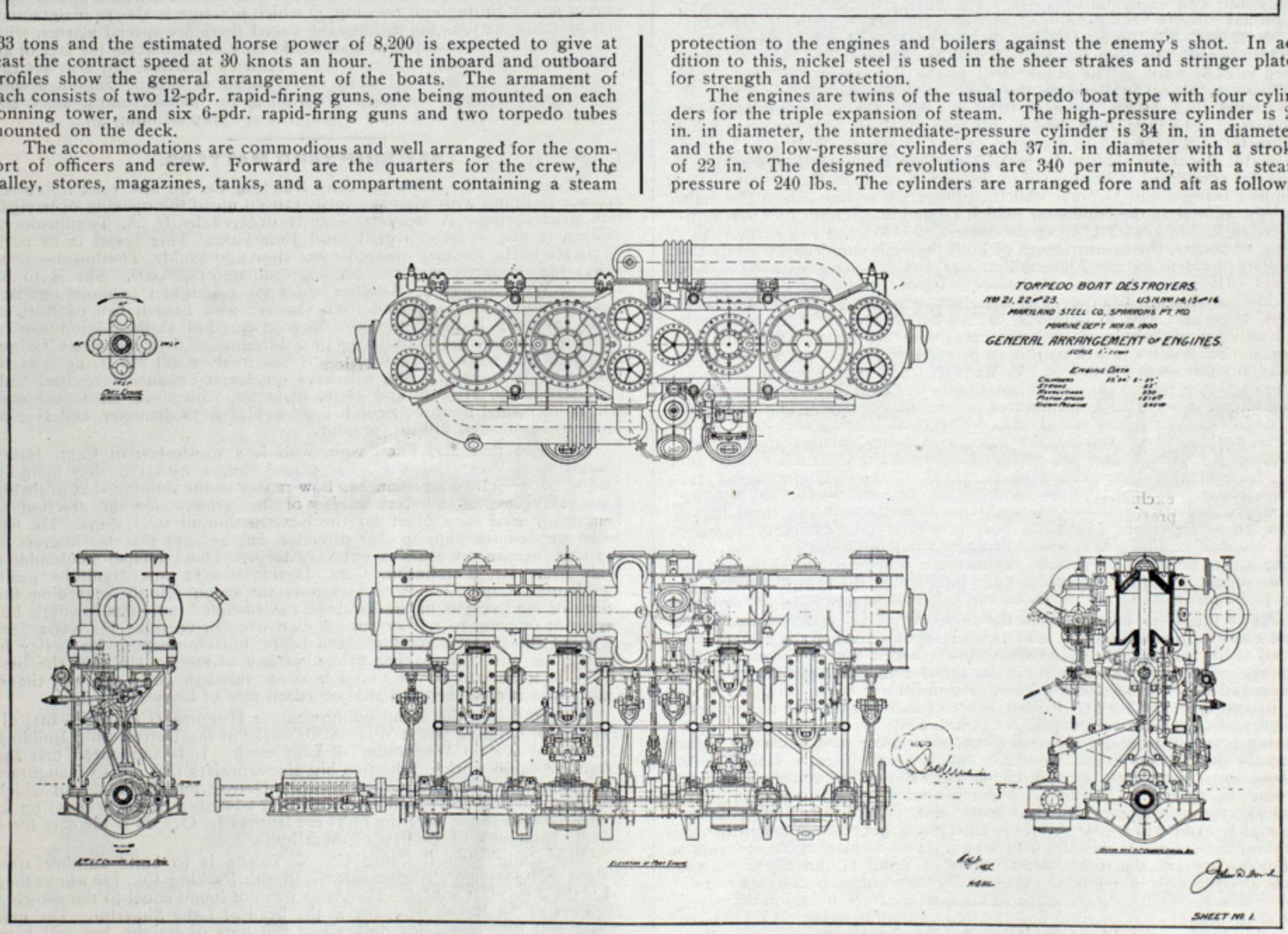
The turbine steamer King Edward is reported to be sold to an English syndicate for service in the south and a successor is to be built by Messrs. William Denny & Bros., Dumbarton, for next summer's tourist traffic on the Clyde.

LARGEST TORPEDO BOATS OF ANY NAVY.

The triple launching of the torpedo boat destroyers Truxtun, Whipple and Worden on Aug. 15 calls attention to the three largest of this class of war vessels built or building for the United States government, or any foreign power. They are 259 ft. 6 in. long over all; 248 ft. long on the trial load line; 23 ft. 3 in. wide at the deck; 22 ft. 6 in. beam at the load line, and 14 ft. 8 in. deep amidship. The estimated trial displacement is 433 tons and the estimated horse power of 8,200 is expected to give at least the contract speed at 30 knots an hour. The inboard and outboard profiles show the general arrangement of the boats. The armament of each consists of two 12-pdr. rapid-firing guns, one being mounted on each conning tower, and six 6-pdr. rapid-firing guns and two torpedo tubes mounted on the deck.

The accommodations are commodious and well arranged for the comfort of officers and crew. Forward are the quarters for the crew, the galley, stores, magazines, tanks, and a compartment containing a steam windlass. Off the galley is a dry room and on the same deck shower baths are fitted. The turtle deck partially protects the conning tower and shields the crew in rough weather. Here are provided lavatories for the crew and stowage for spare torpedoes.

Aft of the machinery spaces are arranged the quarters for the firemen, machinists and petty officers. The staterooms and ward rooms for the officers occupy the remaining space on the lower deck in the stern. Under this deck are a magazine, store rooms and fresh water tank. The officers' rooms are large and comfortably furnished, although all the partitions, furniture, berths, desks, lockers, and wardrobes are of metal. In fact wood-work is avoided wherever possible to reduce the danger caused by flying splinters. The larger part of the space in these boats is taken up with the machinery and coal bunkers. Each engine, with all its auxiliary machinery, is entirely distinct from the other engine and is located in a compartment by itself, one forward of the other. Forward and aft of the engine spaces are the boiler compartments, each containing two boilers, with their necessary feed pumps and blowers. The coal is stored in wing bunkers running the length of the machinery space, thus affording some protection to the engines and boilers against the enemy's shot. In addition to this, nickel steel is used in the sheer strakes and stringer plates for strength and protection.



The engines are twins of the usual torpedo boat type with four cylinders for the triple expansion of steam. The high-pressure cylinder is 23 in. in diameter, the intermediate-pressure cylinder is 34 in. in diameter, and the two low-pressure cylinders each 37 in. in diameter with a stroke of 22 in. The designed revolutions are 340 per minute, with a steam pressure of 240 lbs. The cylinders are arranged fore and aft as follows: First low, high, intermediate, and second low. The high-pressure cylinder is fitted with one piston valve, the other cylinders with two piston valves each. The reciprocating parts are balanced to reduce vibration as much as possible. All materials are of the very best obtainable, nickel steel being employed to a great extent, and the weights are at minimum consistent with the large horse power to be developed. Four boilers of the Thornycroft type supply the necessary steam. The total grate surface of 315 sq. ft. and the total heating surface 17,768 sq. ft. The closed stoke hold system of forced draft will be used for high speeds, large blowers being fitted in each fire room to give the necessary air pressure. The bunker capacity is 185 tons, which is more than that of any other destroyer

built or building in this country or Europe. In soliciting the bids for the sixteen destroyers, of which these three are a part, the navy department encouraged the submission of original plans by the ship builders in order that by actual experiment the relative advantages of different dimensions and arrangements might be determined, and these boats were built upon the designs of the builders.

These three destroyers, building by the Maryland Steel Co., Sparrow's Point, Md., will be useful beyond the range of most boats of their class because of their greater steaming radius and seaworthiness, and the builders' and official trials of these boats will be watched with unusual interest in consequence of their relatively large size and high speed.

DISCOVERY OF ORE NEAR CHAMPION MINE.

Lake Superior iron mining circles are much interested in the recent discovery of a considerable bed of iron ore about a quarter of a mile east of the original opening of the Champion mine. The new deposit is from 4 ft. to 20 ft. in width. If it should widen as it deepens, as was the case with the old workings, it will prolong the life of the Champion mine. Probably in the history of mining throughout the world there has never been so many surprises as there has been in Lake Superior properties. Incredible deposits have beeen won from abandoned and seemingly worthless mines; hundreds of thousands of tons have lain hidden for decades in the midst of ceaseless activity, to be finally revealed through accident. The price of a mine has shrunk from $1,000,000 to $100,000 in six months; and it has expanded also in like proportion. Geologically the country is a riddle. Deductions cannot accurately be made from the formations; a thing is proved only by practical and individual investigation. The Negaunee Iron Herald says of the new deposit:

"The ore is practically an outcrop, there being but from 1 ft. to 4 ft. of stripping, and is shown to be of high grade by a series of analyses. Preparations have been made for sinking, and until this work is somewhat advanced Supt. Fitch declines to express an opinion as to its extent, though the substantial equipment provided for the exploratory work may at least be taken as evidence that he has considerable confidence in the value of the new discovery, in spite of the fact that the constantly-changing conditions of the old workings during his long connection with the company, have caused him to become conservative and cautious in any estimate of future prospects. The old mine is now looking better than for some years, the ore breadth at the bottom—1,900 ft. from the surface—being about 100 ft., with every appearance of still widening as further depth is attained. Should it transpire that the new find will develop as the big end of the old Champion, as many are willing to predict, it will be but the strongest of evidence in support of the contention of many, that the mining industries of the country are yet in their infancy. Besides this instance, other recent discoveries are not wanting. In this line may be cited the large deposits of ore recently located on the Hartford at Negaunee and on the more recently acquired mineral holdings of the Cleveland-Cliffs company at the same place, but little more than a stone's throw from the point where the first ore in the country was discovered nearly sixty years ago. Whatever may be the result of the discoveries here noted, it is perfectly safe to say that no adequate estimate can be made of the future possibilities of the county, in respect to the production of all grades of ore of marketable value."

PRESIDENT McKINLEY'S LAST SPEECH.

Almost the last words of President McKinley were an indorsement of the shipping bill. In his speech made at Buffalo the day before he was shot, the last speech of his life, he said:

"Reciprocity is the natural outgrowth of our wonderful industrial development under the domestic policy now firmly established. What we produce beyond our domestic consumption must have a vent abroad. The excess must be relieved through a foreign outlet, and we should sell everywhere we can and buy wherever the buying will enlarge our sales and productions, and thereby make a greater demand for home labor. The period of exclusiveness is past. The expansion of our trade and commerce is the pressing problem. Commercial wars are unprofitable. A policy of good will and friendly trade relations will prevent reprisals. Reciprocity treaties are in harmony with the spirit of the times; measures of retaliation are not. If perchance some of our tariffs are no longer needed for revenue or to encourage and protect our industries at home, why should they not be employed to extend and promote our markets abroad? Then, too, we have inadequate steamship service. New lines of steamers have already been put in commission between the Pacific coast ports of the United States and those on the western coasts of Mexico and Central and South America. These should be followed up with direct steamship lines between the eastern coast of the United States and South American ports. One of the needs of the times is direct commercial lines from our vast fields of production to the fields of consumption that we have but barely touched. Next in advantage to having the thing to sell is to have the convenience to carry it to the buyer. We must encourage our merchant marine. We must have more ships. They must be under the American flag, built and manned and owned by Americans. These will not be profitable in a commercial sense; they will be messengers of peace and amity wherever they go. We must build the isthmian canal, which will unite the two oceans and give a straight line of water communication with the western coasts of Central America, South America, and Mexico. The construction of a Pacific cable can not be longer postponed."

RAFT TOWING ON THE PACIFIC.

The Puget Sound tugboats, Tatoosh and Richard Holyoke, have just towed an enormous raft from Westport, seventy-five miles below Portland on the Columbia river, to San Francisco. The raft contains 7,200,000 ft. of lumber, equal to fifteen good cargoes. The trip was practically without incident. The raft was built at Westport by the Robertson Raft Co. and $30,000 was expended in its construction. A large force of men was employed for eight months in the work. Eight thousand piles, some of them 122 ft. long, were formed in a cigar-shaped mass that was 625 ft. long, 60 ft. broad and 32 ft. deep. To hold these timbers many chains, aggregating in weight nearly 70 tons, were bound around the raft at intervals of a few feet, and a towing chain extended throughout the length of the raft.

DESTRUCTION OF TORPEDO BOAT DESTROYER COBRA.

It is a great misfortune that both of the English torpedo boat destroyers, Cobra and Viper, the only two war vessels in the world fitted with turbine engines, should have been destroyed within a very few weeks of each other. In neither case was the type of engine in any way to blame. The Viper ran on a rock in the English channel and was literally smashed to pieces. The cause of the wreck of the Cobra is not quite clear, but it appears to have been due to the lightness of her construction. She broke in two in a heavy sea. The vessel was proceeding slowly in the North sea at the time of the accident. Weight had probably been sacrificed to speed to a dangerous degree in the construction of the Cobra. The wreck of the Cobra is the greatest loss which the English navy has received since the Camperdown sank the Victoria. Sixty-seven persons perished, of which forty-five were naval men. Among those who were drowned were Mr. Sanderson, superintending engineer of the Armstrong works at Elswick, and Mr. Barnard, manager of Parsons' turbine company. Mr. Barnard partly designed the Turbinia, the first vessel to be fitted with turbine engines, and supervised the building of the Viper, Cobra and King Edward. Lieut. Bosworth Smith, the Cobra's commander, stood upon the bridge with his arms folded as impassive as if on parade and went down with the vessel. The admiralty is not discouraged, but has placed an order with the Elswick works for another boat of the Parsons turbine type. In an unofficial test last year the Cobra beat the record of the Viper and won the title of the fastest vessel in the world. The record of the Viper was 43 miles an hour and that of the Cobra 43.5 miles.

FRENCH BILL TO PROMOTE SAFE NAVIGATION.

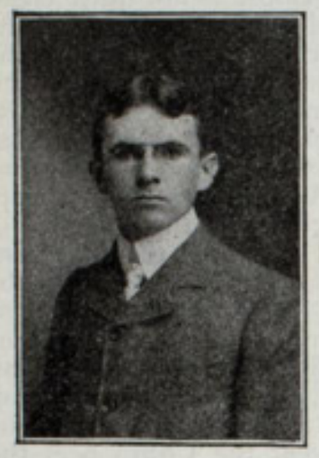
The chamber of deputies of the French government is now considering a bill to promote the safety of navigation. The bill has been referred to the Havre chamber of commerce for examination and has just been reported upon by that body. The bill is divided into four parts. Part I, with seven clauses, provides that every French merchant steamer or fishing vessel shall be inspected by a visiting committee, whose duty it shall be to see that she is in a seaworthy condition in every respect; to verify the draught as declared by the owner and to fix the maximum number of passengers, if a passenger boat At the recommendation of this committee the "maritime authority" will grant a navigation certificate, without which the vessel must not go to sea. In the case of a vessel purchased or built abroad for French owners, she must be visited and inspected by the French consular authority before she leaves the foreign port, and must not sail without a provisional navigation certificate. Further it is provided that every vessel shall be inspected in a light condition by a visiting committee at least once a year, as well as, in the interval, every time that she receives any damage, and the navigation certificate will be suspended until the necessary repairs have been executed. Every time an inspection is made the owner of the vessel must pay a fee not exceeding 5 centimes per register ton gross if an oversea vessel and 3 centimes if a coasting or fishing vessel. Lastly it is laid down that the visiting committees shall be exclusively amenable to the marine department. Part II of the bill (one clause) recites the rules to be imposed for securing the safety of navigation, relating to the draught, number of passengers, number of watertight bulkheads, life-saving appliances, special measures of precaution, and the outfit and equipment generally. Part III (six clauses) fixes the penalties (ranging from 50 to 4,000 fcs.) to be imposed on ship owners who send their vessels to sea without a navigation certificate, and places such delinquents under the jurisdiction of the maritime commercial tribunals. Part IV (six clauses) consists of "general provisions," one of which is that "vessels affected to the transport of emigrants or mails are not submitted to the provisions of the present law," and another to the effect that "the present law and the regulations laid down for its execution may be made applicable, in whole or in part, to the vessels of foreign countries in which French vessels are submitted to analogous regulations."

The special commission has now reported on this bill. The commission approves the idea that, in view of the incessant changes made in the materials used in ship building and in the conditions of navigation, it is the duty of the public authorities to seek out means for securing the greatest possible safety for crews, passengers and cargoes, and that an important step may be taken in this direction by modifying those rules which appear antiquated or by laying down new ones. These modifications, however, ought not to raise obstacles to maritime commerce, estranging ship owners by the application of draconian regulations imposing on them a too heavy responsibility. The commission, therefore, protests against any meddling of the naval authorities in the nomination of the committees for the inspection of merchant ships, and points out that such meddling would have no other effect than the creation of a new and useless category of functionaries. The commission protests most energetically against any arrangement tending to bring ship owners under the jurisdiction of either naval officials or of naval tribunals. It is suggested that the visiting committees as at present constituted might be strengthened by the addition of a ship builder or an agent of a classification register, "but the appointment of the members of these committees ought to be left in the hands of the tribunals of commerce, the mayor, or the consular authority at the port to which they are attached." As regards the exemption of mail and emigrant vessels from the provisions of the bill, the commission agrees with that proposal "if the conditions to which such vessels are submitted are equivalent to those laid down in the new bill, but, in the interests of safe navigation, these conditions ought to be indicated." With many of the provisos of the new bill the commission is in accord, and the report, after having been adopted by the Havre chamber of commerce, has been sent to the minister of commerce.

The Duluth, Mesabi & Northern Railroad will replace a number of the bridges on its line in the coming few months. Many of the bridges have not been replaced since they were built in 1893. The heavier ore cars which are now used are also responsible in a considerable measure for the replacing of the bridges by new structures. Fifty-ton cars are used very generally now and it is quite a different matter to bear a train-load of 50-ton cars from carrying one of 30 tons. The bridges will be replaced by steel structures designed to carry very heavy cars and to last for many years.

GEORGE CROUSE COOK.

The name Geo. Crouse Cook attached to several articles on subjects of naval architecture during the past two years is familiar to readers of the Review. Mr. Cook is a young man whose training, preparatory to opening an office in New York, is worthy of attention. He was born in 1875 at Fort Plain, N. Y., of one of the old and well-known families of the Mohawk valley. After the usual grammar-school training he entered a private military academy, where he remained until the Webb Academy for Ship Builders was opened, and, having qualified in the entrance examinations, entered and graduated with the first class in '97, receiving the first diploma issued by that academy. During this time he also served as an apprentice in the ship yard of Dialogue & Son, Camden, N. J., and as an assistant on the engineers staff of the S.S. Europe of the Atlantic Transportation line. Having qualified in the United States civil service examinations for the navy department, he was sent to Washington, but on being assigned to the ordnance bureau he resigned to enter the hull department of the Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, where he remained for two years, engaged in general drafting and calculating on merchant and naval work. From the Cramp works he entered the University of Glasgow, Glasgow, Scotland, where he was a student of engineering and naval architecture for two years. In his second year he was awarded by the university the senior class naval architecture prize—the first American from civil life to be so honored. Following the Glasgow university training he was employed by the Howaldtswerke, Kiel, Germany, where he had charge of three vessels. This was his last service in a ship yard. He has now established an office in the Kemble building, Whitehall street, New York city, as general ship draftsman and designer, and is at present preparing a 105-ft. design for one of the New York transportation companies..



Mr. Cook is an associate member of the Society of Naval Architects and Marine Engineers, New York; associate member of the Institution of Naval Architects, London; and was a member of "Congres d'Architecture et de Construction Navales," which met in Paris in 1900. In 1899 he was married to Miss Florence E. Bradford of a well known ship building and seafaring New England family. As a daughter of the male line of Gov. Wm. Bradford of the Pilgrim colony at Plymouth, Mrs. Cook is a prominent member of the Society of Mayflower Descendants. Mr. Cook writes on general topics in the field of naval architecture and has made a special study of the naval architecture schools of the world, with a view of fitting himself for academical work in his profession.

Any retrospect like that taken by General Manager Swank of the American Iron & Steel Association on "Iron and Steel at the Close of the Nineteenth Century," gives great significance to statements such as the Pressed Steel Car Co. has made recently, as to the tonnage of steel entering into its cars month by month. It can scarcely be realized that this industry, whose beginnings go back only four years, is now requiring in the shops of the single company named over 1,600 tons of plate and shapes a day, or fully 500,000 tons a year. Here is a new outlet for the product of our steel mills that requires a tonnage almost equal to the entire make of our open-hearth steel plants ten years ago. Such facts tell the story of the advance of our iron and steel industry, which in very truth has been in recent years by leaps and bounds.—Iron Trade Review.

MR. CHARLES H. CRAMP ON THE TURRET QUESTION.

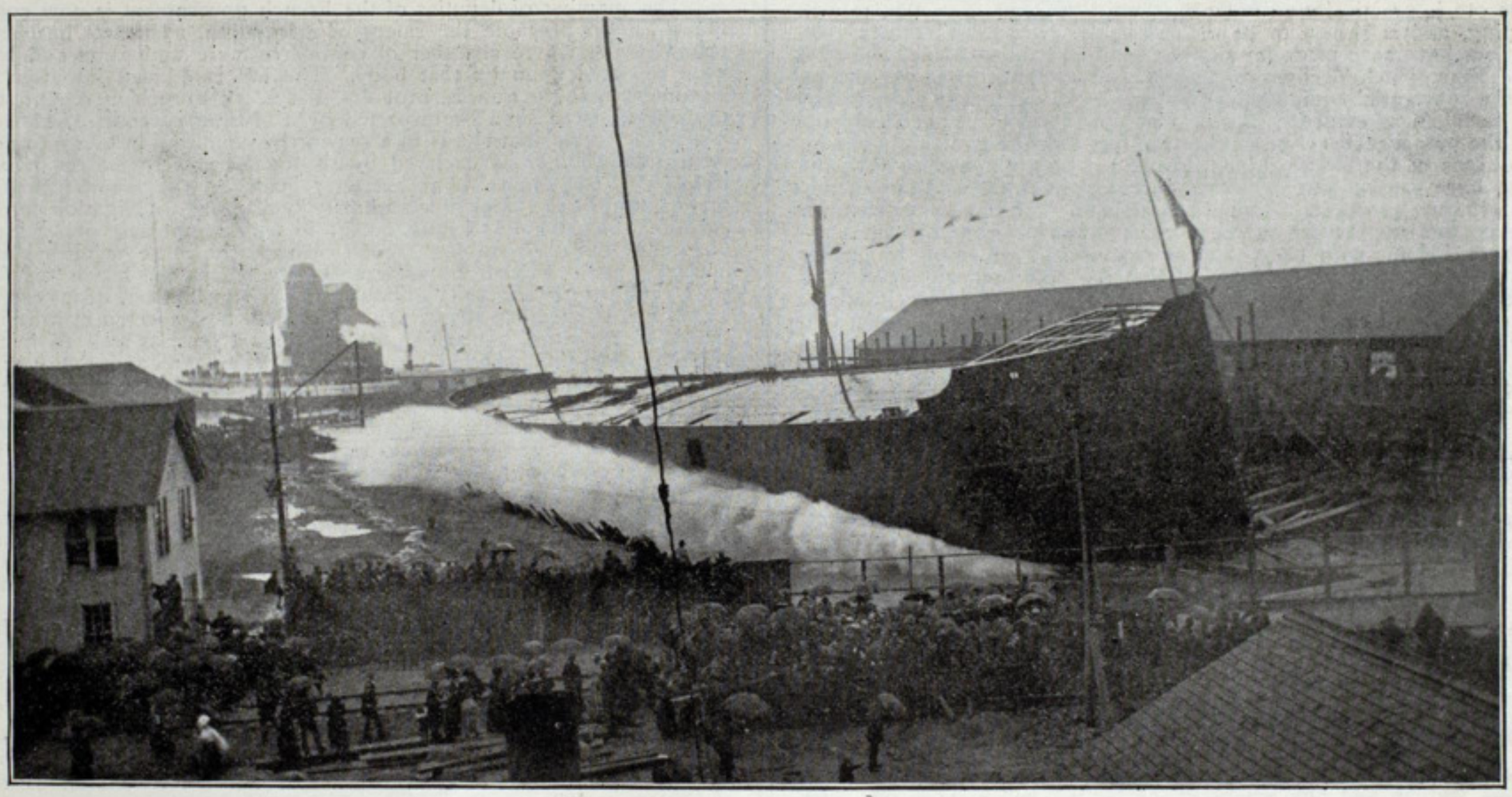
Mr. Charles H. Cramp, the veteran ship builder of Philadelphia, is opposed to the system of superposed turrets which has been introduced on the Kearsarge and Kentucky and which is now being urged for some of the other battleships. He is also opposed to covers on top of some of the single turrets. At least he quotes many officers who were in the fight at Santiago as expressing the opinion that there should be no top on a turret, for the reason that the ventilation is so bad, and the facilities for observation so poor in time of battle, that officers cannot well direct affairs from a closed turret. In a letter to Rear Admiral Bowles, chief constructor of the navy, Mr. Cramp says:

"I think that the majority report of the board has in its design for the new battleship provided the best possible scheme of gun capabilities and protection. While my objections to the use of the superposed turret, I think, are convincing, particularly on account of the excessive movable weights consequent, and the impossibility of sighting the gun, to say nothing of the equally important consideration of its vulnerability, I would recommend turret protection for the 12-in. guns. The line should be drawn here. All guns of smaller caliber, excepting possibly the 10-in., should be mounted with casemate protections, and their shields used only when firing in broadside or from the ends of the casemates.

"The liability to complete disablement of a single turret with two guns is, of course, beyond question. In a superposed turret two more guns in each turret are involved in the trouble, and certainly render the question more complex. In the examination and investigation of the subject of fighting in turrets I have ascertained the views of many of the officers who were in the turret during the engagement at Santiago, and I feel convinced that there was hardly a shot fired during that battle or in any of the bombardments under conditions that ought to be. I have been informed by an officer of the navy who was in command of an 8-in. gun turret at the battle of Santiago that as soon as the firing began he abandoned the sighting hood and lifted the manhole cover on top of the turret. This he found it absolutely necessary to do in order to obtain that view of the situation which he deemed necessary to proper execution of his duties. This officer further informed me in reply to an inquiry as to the personal exposure involved that he considered it safer to stand in that manner, with his head and body exposed, than with his head in the sighting hood. At any rate he preferred it. This is by no means an isolated case. Other officers who served in turrets during the Spanish war have declared emphatically that they would rather have the entire top removed, leaving the turret completely open above, for the reason that it was impossible to sight or work the guns satisfactorily in the confined and closed space; that even the ventilation, no matter what kind of powder was used, whether black or smokeless, was a serious question. With the open tops there would be good ventilation, and above all an opportunity for the officer or officers in charge to look over the upper edge of the turret and see what was going on, instead of having their view of the situation confined to the small peep holes which prove utterly useless in action."

A charter was granted this week to the Sharon Sheet Steel Co., Sharon, Pa. The incorporators are John Stevenson, Jr., Nevin McConnell, David Adams and James P. Whitia of Sharon, George W. Darr of New York, and Senator William Flynn of Pittsburg. The Sheet Steel company will at once begin the erection of ten modern sheet mills, and, in addition, will erect a mammoth galvanizing plant. These improvements will cost about $600,000, exclusive of machinery. The company also has under contemplation the erection of ten more sheet mills, making a twenty-mill plant. The Sharon Sheet Steel Co. will be a strong competitor of the American Sheet Steel Co.

First Steel Vessel Constructed in Canada.



LAUNCH OF THE HURONIC AT THE WORKS OF THE COLLINGWOOD SHIP BUILDING CO., COLLINGWOOD, ONT.

CHANGE IN TUG MANAGEMENT.

Within the past week the Great Lakes Towing Co., which controls all harbor tugs and much of the wrecking appliances throughout the lakes, has accepted the resignation of Capt. W. A. Collier, general manager, and has appointed as his successor Capt. Cyrus R. Sinclair of Chicago.

THE NEW TUG MANAGER.

Capt. Sinclair has already taken up his new duties and will make his headquarters in the Cleveland general offices of the company. Although the newspapers have given considerable prominence to this change of management in the tug organization, intimating that the cause was mysterious, it has been made without friction and is due to a condition that often arises in the ordinary course of business. For a great many years past Capt. Collier has applied himself very closely to business—and that means a great deal in the management of tugs. He was successful to the extent that he was one of two or three men who brought into a single organiaztion all of the tug interests of the lakes No one else was spoken of for general manager of the new organization. The place fell to Mr. Collier by right of the progress he had made before the so-called trust was formed and by right also of the part he had taken in organizing the general company. But for various reasons the larger organization has not made a great deal of money. It was the opinion of principals in the company that a general manager should spend probably one week of the month at home and the other three weeks following up local offices, wrecking jobs, etc. Alike to a great many men who feel comfortable in the business sense after years of hard work, Mr. Collier wanted a fair share of his time with his family and some of the home life that he had missed during the past fifteen years or more. This is the main reason why a change has occurred in tug management. Mr. Collier will rest for a few months. He has no special plans for the future, but will not be idle. He is too young for that. He certainly leaves a host of friends in quitting the tug business. He has the faculty of making friends, and for one of his opportunities has a broad disposition in business dealings that will always serve him to advantage. His successor, Capt. Cyrus Sinclair, is equally well liked and well known in every part of the lake region. He has had much to do with the handling of men all his life and knows the tug business. He is also thoroughly acquainted with everything pertaining to wrecking operations and undertakes his new duties under circumstances favorable to success. He was the unanimous choice of the directors of the tug company.

COAL SHORTAGE AT LAKE MICHIGAN PORTS.

C. W. Elphicke & Co., vessel agents of Chicago, have just issued a statement which shows an aggregate of 1,632,701 tons of coal, hard and soft, received at Lake Michigan ports to Sept. 1 of this year, compared with 2,055,881 tons on the same date a year ago. The statement follows:

	To Sept. 1, 1901. Tons.	To Sept. 1, 1900. Tons.
Chicago	451,833	666,260
Manitowoc	114,708	166,139
Milwaukee	801,322	917,408
Sheboygan	128,534	148,621
Racine	60,241	41,617
Green Bay	76,063	115,836
	1,632,701	2,055,881

"This shortage in round numbers of 425,000 tons," says the Chicago report, "would seem to indicate a heavy coal movement and higher freights to Lake Michigan for the balance of the season. Receipts during the month of September, to date, have been large, but not so large as to make up proportionately for the deficiency shown above. The Lake Michigan coal docks are in shape to give vessels good dispatch."

Stocks of grain in elevators at Chicago and South Chicago are thus reported:

	Sept. 23, 1901. Bu.	Sept. 1, 1901. Bu.	Sept. 24, 1900. Bu.
Wheat	8,685,000	6,856,000	19,987,000
Corn	11,918,000	11,477,000	3,081,000
Oats	2,712,000	2,942,000	5,621,000
Other grains	340,000	284,000	791,000
	23,655,000	21,559,000	29,480,000

The circular says that improvement in Chicago grain freights, now based upon 1¼ cents on corn to Buffalo, is not looked for in the immediate future.

A chart of the Detroit river in colors—the best chart of the river ever printed—has just been issued from the Detroit engineer office. It takes in everything from Windmill point to Bar point. All the changes resulting from extensive dredging, shifting of ranges, etc., are very clearly shown, and the corrections are, of course, up to date. This chart may be had from the Marine Review.

A Boston correspondent, writing of the extensive business of the Chelsea Clock Co., says that that concern is now filling an order for 100 clocks from the United States navy department. Special makes of Chelsea clocks for ships, yachts, etc., are sold by dealers in nautical instruments and ship chandlers all over the country.

P. H. FLEMING.

Mr. P. H. Fleming of Chicago, who died in Denver, Col., on Friday last, was known to vessel men in all parts of the great lakes region. Although only in his forty-second year, he had been identified with Chicago shipping interests for twenty-five years. He began as a young man with Atkins & Beckwith, vessel agents, who were well known in the

days of wooden ships. His advancement with this firm, which was later Beckwith & Fleming, was quite rapid. Still later in the firm of P. H. Fleming & Co., as it exists at present, Mr. Fleming developed an extensive marine insurance business, while representing also other important interests kindred to the vessel agency. From 1888 to 1891, inclusive, he was general western manager of the Lehigh Valley Transportation Co. and for the past twelve or fifteen years general agent of the Union Marine Insurance Co. As head of the firm of P. H. Fleming & Co. he was in touch with its affairs up to the time of his death, although his health did not admit of active attention to business for a long time past. The funeral took place in Chicago Tuesday.

AROUND THE GREAT LAKES.

Capt. C. C. Balfour a few days ago resigned command of the steamer Venus to take charge of the new steamer Frank H. Peavey.

The Grand Trunk Elevator at Point Edward, opposite Port Huron, which has stood for forty years, was burned Monday. The loss is about $70,000.

The Menominee & Manistee Transit Co. of Menominee, Mich., has sold the freight and passenger steamer City of Marquette to the Hill steamboat line of Fish Creek, Wis. Consideration said to be $21,000.

McCarthy Bros. & Co., Duluth and Minneapolis grain men, will build at Rice's point, near Duluth, during the coming winter, a steel elevator of 400,000 bushels capacity, with a steel tank annex, having a capacity of 1,600,000 bushels.

The resignation of John A. Donaldson of Cleveland, who was in charge of all of the Lake Erie dock property (car dumping machines, steamboat fuel plants, etc.), of the Pittsburg Coal Co., very probably means some new undertaking in the coal industry. Mr. Donaldson is thoroughly posted in everything pertaining to the shipment of coal by lake and is deservedly popular.

In twenty-four hours ending Thursday evening of last week, 143 vessels passed up and down the Detroit river. On a previous date this season 125 vessels passed Detroit in twenty-four hours. Nearly three-fourths of the passing fleet Thursday were ships bound down from upper lake points, where they were held in shelter awaiting the abating of a gale that raged more or less furiously for three days.

James A. Calbick has been elected president and George L. McCurdy secretary and treasurer of the Great Lakes Sailors' Snug Harbor, which has established headquarters at Chicago. They will care for any subscriptions that may be made towards the founding and maintenance of a home for sailors of the great lakes, a matter that was discussed at the last annual meeting of the Lake Carriers' Association.

The dissolution of the Menominee and Mutual transportation companies by court proceedings in Cleveland a few days ago was simply a formal legal proceeding. These companies owned two fleets of vessels that were managed in the office of M. A. Hanna & Co., and which included the Roman, Grecian, Corsica, Cambria, etc. The ships were sold more than two years ago to the National Steel Co. and later taken over by the United States Steel Corporation, so that they are now numbered among vessels of the Pittsburg Steamship Co.

A Chicago dispatch says that underwriters charge the loss of the steamer Hudson, which foundered on Lake Superior a few days ago, to the 23,000 bushels of flaxseed which formed a part of her cargo. "Flax will run when a ship is in a seaway," said one insurance man, "like quicksilver. It is almost impossible to hold it in one place. I presume the Hudson became disabled from some cause and then the flaxseed all went over to one side, giving the ship a heavy list. The work of destruction by the seas was then rapid and easy." Many lines dislike to take flaxseed at all. Some never load it on their steamers except when the rest of the compartment is filled tight with flour or other firm freight.

HULL DESIGN.

George Crouse Cook.*

The value of the word "design" in relation to ship work is much disputed and its specific meaning is generally empirical. In some cases it is used to define the determination of dimensions, in others the disposition of material in the structure, or the internal arrangement; and again, as I have here assumed, the determination of the form of the under water body or disposition of displacement. Each of these meanings has its obvious justification, but the last seems to have greatest claims for correctness, as the calculations for centers in determining trim and stability, for loads in the questions of strength, and resistance in the estimation of horse power are based on this disposition of the displacement and its factors. On the other hand the weights, the disposition of the material in the structure and the internal arrangement are usually shifted to give results required by calculations on the form, and often the dimensions themselves are modified to fulfill a condition of stability or strength, while a similar form is held.

Accepting this then as the meaning of the word design, the question of efficiency of a design reduces to the determination of the form of least resistance. Many great men in the world of naval science have given of their lives to the investigation of this problem, and among the greatest of these is Scott Russel, whose wave-line theory developed a beautiful form, the water lines of which were composed of trochoids and versines of certain length in relation to the speed. This, as the form of least resistance, was disproved by the practical model towing experiments of Froude, but it survives in part, however, in that the curve of sectional areas or the longitudinal disposition of the displacement, which is now the accepted factor in resistance as far as it may be determined by form alone, is composed of the curve of versines and the trochoid. (See Fig. 1.) The fact that the longitudinal disposition of displacement is the factor of form in resistance can be fairly justified by an analysis of radically different designs of the same type, as for instance, the V shaped stern sections of the U. S. S. Porter and the flat box form sections of the U. S. S. Farragut give quite similar sectional area curves, while both are highly successful in their respective classes.

The construction of the versine curve and trochoid for the sectional areas of a form and their conversion to a line draft of known qualities is most simple and practicable and the entire work may be carried to such a point as to determine the outlines of the decks and to give a basis for calculations of capacities, etc., in the course of an hour. Taking up the most simple case at first, that is where the required displacement will allow a block coefficient of .5 to .55, which includes many types in which speed is at all aimed at, the work may begin from the basis of length, breadth and draught, which for convenience may be marked L, B and d.

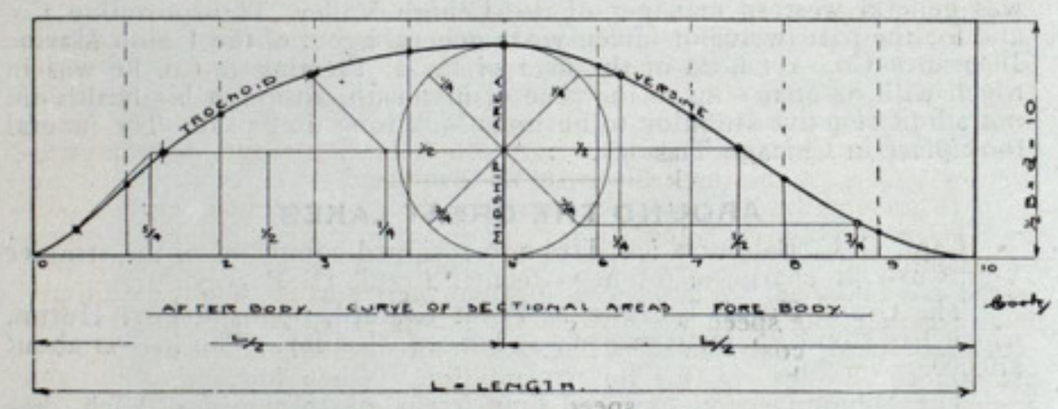


FIGURE 1.

The outlines of Fig. 1 are drawn to represent on any convenient scale the block of the vessel—the horizontal measurement in linear feet, while the vertical ordinate represents the area of the block; that is ½ B x d, as in the line draught, but one side of the form is drawn. The work may be facilitated by taking the vertical scale so that ½ B x d = 10, as with this the area shown by the curve of areas at any point on L may be read off and plotted on the body plan as a decimal of the transverse area of the block. Now, from some ship of a similar type, or from empirical knowledge, the form of the midship area, within the limits of ½ B and d, is drawn and its area calculated. This area is then set up at ½ L on the vertical scale of the block and it at once graphically shows the true relation between the midship section and the transverse block area. In chosing the area of the midship section the limiting factor may be taken in the prismatic coefficient, that is the displacement divided by the midship area into the length, and this coefficient should never, in well-formed hulls, be lower than .56.

On this vertical at ½ L representing the midship section, Fig. 1, a circle is drawn, and from this as a basis the curve of versines for the sectional area of the fore body and the trochoid for those of the after body are drawn, and these two curves make up the correct disposition of the displacement. The construction of these curves is very simple. In the case of the versine curve the forward half length and the forward semicircle are divided into the same number of equal parts, say four; horizontal lines are drawn through the points on the semicircle and vertical ones through the points on the base; then the intersection of the corresponding vertical and horizontal lines determines the points on the curve. For the trochoids, or the curve of the after body, the after half length and the after semicircle are divided into the same number of equal parts, say four; radii are drawn to each point of division on the semicircle, and from the corresponding points on a horizontal through the center of the circle lines are drawn parallel and equal to the radii; the ends of these lines will then determine the points of the curve.

To construct a body plan from this curve of sectional areas the number of the stations required, say ten, are set off on L and the decimal reading of the areas at these stations measured. In the outlines or molded lines of the body plan, as Fig. 2, these readings are plotted by the use of a tenth scale, placed so that 0 is on the center line and 10 on the side line, and vertical lines drawn through these points will form a body plan, the sections of which, while correct in area, represent a vertical-sided, flat bottomed vessel.

To transform this rectangularly-sectioned plan to one of the accepted ship-shape form a curved line section is drawn (as shown for several sections in Fig. 3), of the same area as the corresponding rectangular section. The accuracy of the substituted area may be checked by running a planimeter over the part taken from the rectangular section and the part added to it which must, of course, be equal; or a tracing may be made of each of these parts and by superposition an estimation of their equality may be

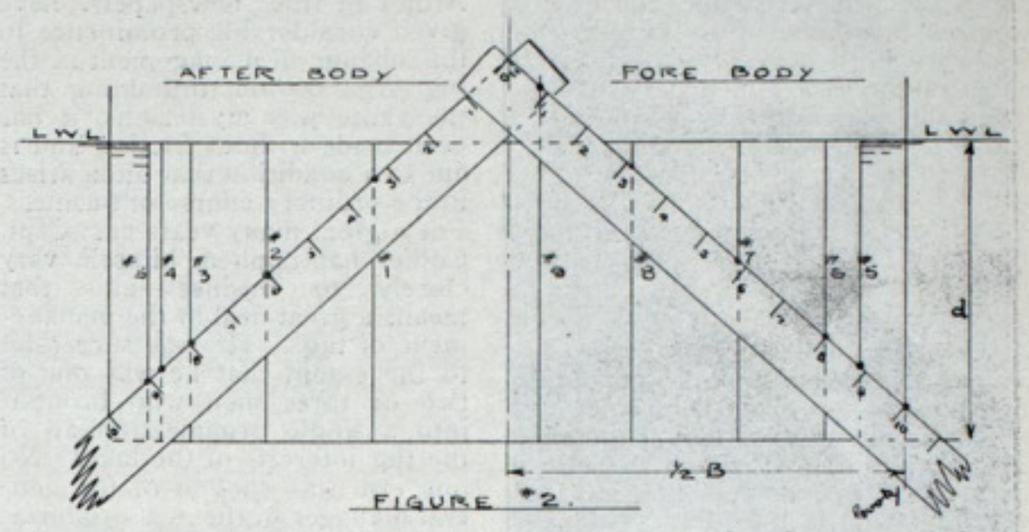


FIGURE 2.

gained. This process is carried out with each section in turn. A body plan so derived will give the correct displacement and merely needs fairing by longitudinal lines on another sheet to be complete. In drawing out each curve care must be taken that they are of the character of the adopted midship section, and in the first fairing, which needs consist of but the load and one intermediate water line, together with a single diagonal, care must also be taken that any modification of the form is not allowed to effect the area of the section, as this would, of course, cause a flat or hump in the curve of sectional areas, on the fairness of which the resistance factor of form is based. The form, as determined absolutely by these two curves, is often unnecessarily fine, particularly toward the ends, and it may be modified to give a somewhat greater displacement with practically no increase of resistance. Perhaps the most satisfactory method of obtaining this on the same length is to add 2 or 3 per cent. of L to the afterbody and 3 or 5 per cent. of L to the forebody, then construct the two curves on this lengthened base and snub in the ends of the curve to the original terminals. This method may be carried out to gain a block coefficient of .6, or a certain length of middle body may be introduced in conjunction with the versine and trochoid as ends, to raise the coefficient. When coefficients of .65 and above are required the speed is usually quite low and the form of lesser account, therefore, some general method of investigation, as "Kirk's Analysis" serves quite satisfactorily.

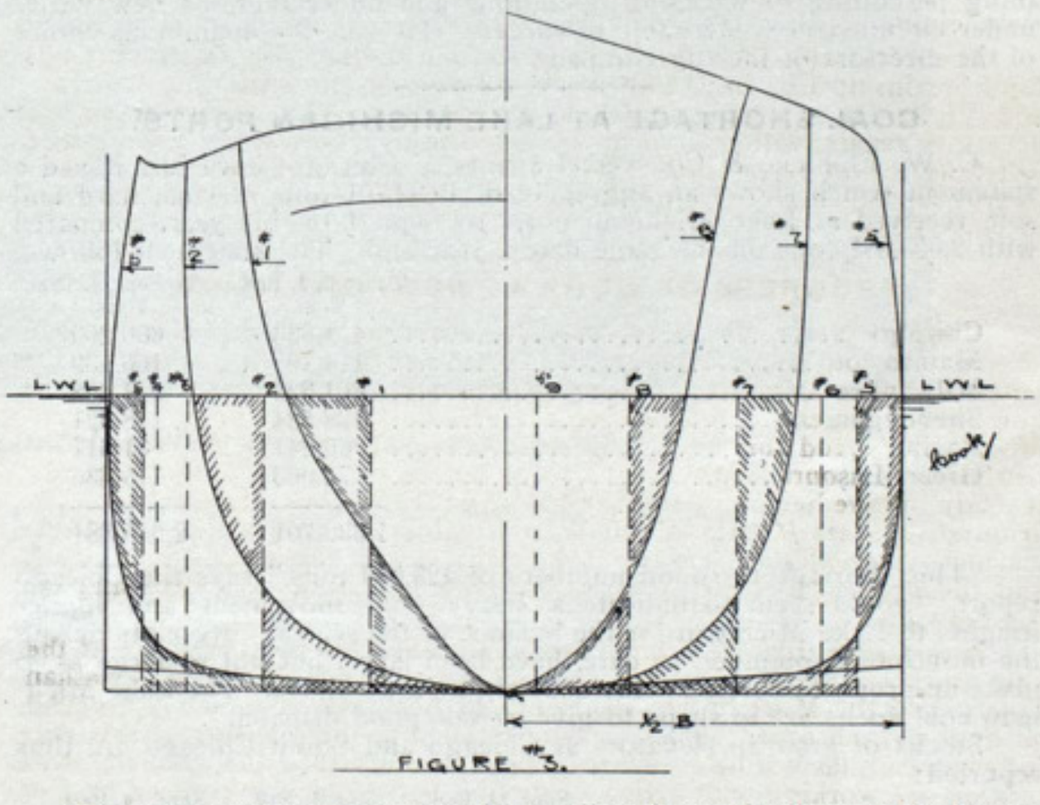


FIGURE 3.

The form of the out-water body usually follows the lines of the lower, but may, of course, be varied to suit the conditions of the required service or to please the eye. In deciding on the sheer it is convenient to draw a fore-and-aft horizontal line on the sheer plan at the lowest point allowed by the conditions of freeboard, appearance or convenience, and draw the sheer line up from this fore-and-aft as may be necessary or appropriate. In like manner the deck line may be limited, a fore-and-aft line being drawn at the greatest width of the section at the corresponding sheer height and the deck line drawn in from it as suitable to the conditions and appearance. These two lines are then transferred to the body plan, the sections carried up to their proper terminals and the body plan is complete for any object to which it may be put.

It is the earnest desire of the writer to eliminate all error or misunderstanding from this article and to advance his own ideas and knowledge on this subject. He will therefore be much pleased to receive and will endeavor to answer any criticisms.

One of the features of the new power house of the Washington Agricultural College and School of Science, Pullman, Wash., is a special Sturtevant steam fan for producing draft on the induced principle for 580 H.P. of boilers. As is the case in several other technical schools this mechanical draft apparatus was installed in part for the purpose of instruction and as a means of acquainting the students with the advantages of this forceful competitor of the chimney.

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SHIP BUILDING AT PHILADELPHIA.

Philadelphia, Sept 25, 1901.—Ship building in this locality has been very quiet since the death of President McKinley, and, with the exception of one pending, no new contracts were made during the week. The Harlan & Hollingsworth Co., Wilmington, Del., will shortly build for the Delaware River Navigation Co. two propeller passenger steamers of a general design similar to the City of Trenton and Quaker City, recently turned out by the Neafie & Levy company for the Wilmington Steamboat Co. They will be equipped with triple-expansion engines and twin screws and will have a speed at least of 15 miles an hour. Since the Wilmington Steamboat Co. invaded the upper Delaware, competition has been very keen between it and the Navigation company. In retaliation the latter concern immediately inaugurated a Wilmington line and intends within the near future to rehabilitate its entire service with a fleet of new steamers. The steamboat Diamond State, chartered by the company, will return to the great lakes, whence she came last spring. This vessel has been overhauled, new boilers installed and other improvements made. There is a better steamboat service at present on the Delaware, both above and below Philadelphia, than ever before in the history of the port, and in view of the favorable reports made by the companies of their earnings there seems to be an ample field for both lines.

Capt. C. P. Goodrich on Monday began his duties as captain of the League Island navy yard, succeeding Capt. Charles E. Clark, who has been given a snug berth in charge of the naval home in this city. No formal ceremonies marked the transfer. Capt. Goodrich's service in the navy has embraced cruises to every naval station in the world and the command of various vessels from the frigate Colorado to the cruiser Newark. On Aug. 8, 1898, Capt. Goodrich fired the last shot of the Spanish-American war at Mancalillo, on the Cuban coast. After the war he was given command of the battleship Iowa. The United States gunboat Castine, Capt. T. C. McLain, arrived at League Island last Saturday from Manila, whence she sailed June 23. She will be immediately taken out of commission.

The bottom of the Russian battleship Retvizan has been examined since her famous successful trial trip and was found in such a foul condition that the greatest surprise is expressed over her creditable speed performance. There is no question in the minds of J. Harry Mull and his assistants in the engine room of the battleship that her revolutions could easily have been increased from 122 to 135 per minute. She had ten fathoms of water under her on her last trial, and it is believed that in deep water she will readily register 19 knots, or a full knot above her contract requirements. The start on the acceptance trial off the Maine coast is set for Oct. 15. Gen. Anthony Brynk and his assistant, Capt. Moeller, who came from Russia to superintend the firing of the guns, will remain in this city to attend.

The Cramps have received some of the armor plate for the new battleship Maine and are making a gratifying progress on the armored cruisers Pennsylvania and Colorado. The Colorado has now several of her frames in place and the Pennsylvania's keel is down for its entire length. The intention of the builders is to bring the Pennsylvania up to her sister ship as soon as possible and then both vessels will speed along together towards completion.

The contract which the Cramps have with the New York & Cuba Mail Steamship Co., otherwise the Ward line, on the steamships Niagara and Vigilancia is simply for their new boilers. The remainder of the necessary repairs will be done at the Erie Basin, New York. The Cramps were the lowest responsible bidders for this work and included in their figures the expense of towing the vessels around here and returning them to New York.

PROGRESS OF WORK AT NEWPORT NEWS.

Newport News, Va., Sept. 25.—Now that the battleship Illinois is in commission and away from the ship yard, work will be rushed on the monitor Arkansas and the battleship Missouri. The Arkansas, which is now nearly 70 cent. completed, will be the next warship to go into commission here, and this event will occur about the first of the year. The battleship Missouri is still on the ways, but it will not be long before she is ready to take her plunge in the waters of the historic James river. The armored cruisers Maryland and West Virginia are nearly 1 per cent. advanced. A good start has not been made yet on the battleship Virginia and the protected cruiser Charleston, although work is progressing on the drawings.

It is stated that the double launching expected to take place at the ship yard will occur Saturday, Oct. 19, when the Pacific Mail leviathan Siberia and the Morgan line steamship El Alba will go overboard within an hour of each other. Positive confirmation of the selection of this date for the event has not been secured, but it is understood that the ship yard officials are working with a view of getting both vessels overboard by that time.

The battleship Illinois, which has been at anchor in the harbor off the ship yard since the day following her commissioning, will drop down to Old Point some time this week and her sea trials will begin shortly. The North Atlantic squadron, consisting of the battleships Kearsarge, Alabama and Massachusetts, have been at anchor off Old Point since the day following President McKinley's death, when they hurriedly returned to the Point from Lynnhaven bay, having started for the southern practice ground fifty miles off the Virginia capes. The Illinois will join the squadron in all probability, but will hardly proceed with it to New York when the ships sail for that destination.

Commencing at noon last Thursday all of the warships in these waters, Fort Monroe and the navy yard across at Portsmouth, fired twenty-one guns at intervals of one minute in honor of the memory of the president. The ship yard closed down entirely for the day and the government offices were closed at the yard. The navy yard suspended operations for the day also. Flags are still at half mast. All of the outbound foreign merchant ships, on learning of the president's death, placed the American flag at half mast on the after mast and went to sea with this mark of respect in evidence. The foreign ships in port as well as all of the American ships, steam and sail, carried the stars and stripes in similar position. A number of foreign ships passing the squadron at Old Point dipped their own flags twenty-one times.

The United States battleship Texas has been placed in dry dock at the navy yard for cleaning, painting and repairing. The cruiser San Francisco, which has been remodeled there, will probably not be ready to go in commission until Nov. 1. Rear Admiral Cotton has returned to the yard and assumed command of the station after a month's leave of absence.

Three steamers well known in these waters have been chartered to follow the America's cup contestants. They are the Plant line steamship La Grande Duchesse, which was built here; the Old Dominion liner Jefferson, which runs here regularly, and the N. Y. P. & N. R. R. steamer Pennsylvania, which plies between Norfolk, Old Point and Cape Charles. The last named steamer has been secured by the New York yacht club as its official boat and it left for the Metropolis early in the week.

PROGRESS IN ENGINEERING.

In the Naval Annual, just from the government press, Lieut. L. R. De Steiguer writes of engineering progress, giving prominence to turbine engines and oil fuel. On these subjects he says:

"Since the last annual of this office there has been little of interest to report upon new designs of machinery. The submarine has been attracting the attention of foreign governments, and boats of this type have been ordered for the navies of England, France, and Sweden. The trials of the Viper and Cobra, turbine destroyers, have been continued in England. The Viper, at a displacement of 370 tons, obtained 36.581 knots on a one-hour's full-power trial, with a maximum speed of 37.113 knots. The revolutions were 1,180 per minute and the air pressure 4½ in. The speed of 37.113 knots represents about 12,300 I.H.P., as compared to the 6,000 or 7,000 H.P. in the ordinary destroyer. This boat has carried out all of her official trials successfully, making the guaranteed speed astern of 15½ knots, exceeding the 31 knots required by over 5 knots, and only consuming 2.38 lbs. of coal per indicated horse power, being allowed 2.5 lbs. per indicated horse power per hour at 31 knots speed. The high speeds made by the Cobra and Viper, the first two boats of this type, have been obtained with practically complete absence of vibration from main engines, which is so excessive in torpedo vessels, and without accidents in the engine room, which are of so common occurrence with the reciprocating engines of this class. Increased speed, efficiency in coal consumption near designed speeds, absence of vibration from main engines, increased stability, increased safety to engine room force owing to absence of reciprocating parts, perfect balancing of engines, reduced weights and cost of attendance, smaller diameter of propellers reducing racing in a sea-way and facilitating navigation in shallow waters, are the principal advantages claimed for the turbine, and they may cause its use in torpedo boats and fast merchant vessels; but the increased coal consumption at low speeds will probably prevent its use in large vessels of war, where the ordinary cruising is done at about one-half the full speed.

"Foreign governments continue to use and experiment with liquid fuel to about the same extent as was reported in the last annual. According to the press the British admiralty intends to renew its experiments with oil fuel on board the destroyer Surly. Borneo oil will be used, however, as the experiments last year with American petroleum were unsatisfactory, owing to the thick black smoke produced.

"Interesting trials have been made on the torpedo boat Ophir, built by Yarrow & Co. for Holland, with the object of testing Holden's system of burning oil. A trial was first made with coal, when a speed of 24½ knots was obtained. When the oil burners were started, using the oil and coal together, the speed was increased 2 knots—i. e., to 26½ knots. The consumption of coal was 2,800 lbs. per hour, and when Borneo oil was introduced, 700 lbs. of this fuel in addition. When burning oil in one boiler—half-boiler power—a speed of 14 knots was obtained with 500 lbs. of oil per hour. The French battleship Jena has completed very satisfactory trials with liquid fuel. When oil and coal were used in mixed combustion the engines passed from 4,000 to 6,500 H.P. in a very few minutes."

STATIONS FOR TORPEDO BOATS.

A recommendation has been made by the Brooklyn navy yard to the navy department at Washington that some measures be taken at once providing for new quarters and more adequate accommodations at the yards for torpedo boats. The formal statement with an explanation is now before the navy department and will probably be one of the earliest questions to be brought before Secretary Long when he returns to Washington. At present there is no provision at the yards for the care of these boats, and in fact there is no adequate quarters in the navy yard for them. It is recommended that on the vacant lots east of dry dock No. 3, in New York, a steel building large enough to store twenty boats be built. There is an area of about 150,000 sq. ft. in the vicinity entirely unoccupied and it is thought this will provide sufficient room for the storing of all the boats now in the service which could possibly accumulate in times of peace. At present absolutely no means of landing torpedo boats exists at the docks and it is a matter of great inconvenience to land them. It is proposed, it is said, that a floating dry dock be built on the water in front of the proposed sheds where the boats can be easily handled. A railway along the shore connecting the dock and shed is also proposed, so that the torpedos can be easily taken from the water and conveyed to the sheds. The benefits of such a system are deemed at the yard to be so obvious that the scheme will recommend itself.

La Savoie of the French line has made her maiden trip at an average speed of 21½ knots. She is 580 ft. long, 60 ft. beam and 39.6 ft. deep. The motive power consists of two sets of triple-expansion engines, each engine having one high-pressure, one intermediate and two low-pressure cylinders. The shafts are of nickel steel. The propellers measure 21 ft. 5 in. in diameter and are three-bladed, the blades of bronze and the hubs of cast steel. On her trial trip the vessel developed over 22,000 H.P. and attained a speed of over 22½ knots. The displacement of the vessel is 15,300 tons. There is accommodation for 446 first-class passengers, 116 second-class passengers and 400 third-class passengers. The dining rooms, both first and second-class, are located on the main deck and the smoking room on the promenade deck. The passenger accommodation includes many novel features, the most striking of which is a telephone in each stateroom, connecting with the steward's room.

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Herr Ballin, the director general of the Hamburg-American line, recently wrote a letter for publication, saying that his line receives a small subsidy only and that is given for its part in maintaining a regular mail service between Germany and the far east. It is not so much what Herr Ballin says, but what he does not say, that makes his letter interesting. The German government ought to be sufficient authority as to whether or not it pays subsidies. In a recent official report transmitted to Lord Salisbury by Sir F. Lascelles, the British ambassador at Berlin, this statement is made:

"The German government memorandum, submitted to the Imperial parliament with the bills proposing the grant of subsidies to the North German Lloyd Co. in 1885, and to the German East Africa Co. in 1890, expressly states that the 'annual sums to be granted as postal subventions in Germany cannot be regarded merely as payment for services rendered, that is to say for carrying the mails that these sums were asked for establishing and subsidizing German mail steamers.' This was fully recognized by the German legislative assembly, to whom the bill was submitted, and no one assumed that the subsidy was merely the value of the postal service, but it was looked upon as value also paid for important interests of the German export industry, the requirements of the navy and of a colonial policy."

Sir F. Lascelles in the report referred to, which was prepared by William Ward, the British consul general, demonstrates that indirect bounties are given by the German government to German steamship lines in the foreign trade to a large but unknown extent. The Hamburg-American line participates in these bounties, but as they are not called bounties Herr Ballin was technically right in ignoring them. Consul General Ward says: "This indirect subsidy cannot be expressed in figures, inasmuch as this bounty is granted in the form of exemptions from payment of customs duties and preferential railway rates." Goods shipped on the German railways for export in German steamships are charged a much lower rate than if shipped on foreign steamers. Consul General Ward says that the indirect bounty in the way of preferential railway rates has been of immense advantage to German steamships and he gives figures to prove it. James Knott of the North of England Steamship Owners' Association testified not long ago before a parliamentary committee that his line had lost a good deal of trade which it formerly got at Antwerp because "cargoes are now diverted to Hamburg on account of preferential railway rates which are tantamount to a subsidy." Sir Thomas Sutherland, president of the Peninsula & Oriental Steam Navigation Co., testified as to the subsidy of $1,650,000, which his line receives from the British government, and then said that the German government paid to a competing German line proportionately a much larger sum. The German government, according to Consul General Ward, pays nearly $2,000,000 annually in direct subsidies. That does not include the $325,000 paid to the Hamburg-American and North German Lloyd lines for carrying German mails to America.

There promises to be a determined effort at the next session of congress to create a new executive department, to be known as the department of commerce and to be headed by a cabinet officer. Duties have so multiplied of late years that the advisability of this departure is now, more than ever, being urged upon congress. It is understood that President Roosevelt has already given the subject some consideration. Just what present bureaus would be included in such a department has not yet been defined, but all that have to do with commerce, such as navigation, statistics, customs, steamboat inspection, consular and immigration, would undoubtedly be transferred to the department of commerce. This subject has been before congress more than once, and a good sentiment has developed for it, but it has always failed because no one pushed it persistently. The enormus expansion in the commerce of the United States calls attention anew to the necessity of having a department devoted to it. It is no longer the question of interpreting a tariff law applicable to the United States alone, as it is quite likely there will be differential tariffs for the colonies. The question will undoubtedly in some form or other come before the new congress.

The record of the practice with the great guns of the North Atlantic squadron on their cruise has been made up aboard Rear Admiral Higginson's flagship, the Kearsarge. It has not been made public, but it is learned that the Kearsarge, with her superposed turrets, holds the record. She smashed at extreme range three targets, which was a better showing than any other ship of the squadron made. The record shoot did not determine, however, the efficiency of the superposed turrets, since there were few shots planted successfully in one target from one turret. It appears that there is difficulty in securing uniformity of aim.

ITS EARNINGS NOT APPRECIABLY DIMINISHED.

The following semi-official statement, asserting in substance that the United States Steel Corporation has suffered virtually no detriment and lost no money through the recent strike, was made public this week in Wall street:

"Now that the steel strike is over, conjectures are being made as to what it has cost the United States Steel Corporation. None of the estimates which have been published, some of them running into millions of dollars, are trustworthy. It can be said authoritatively that there has been no appreciable diminution of the income of the company because of the labor troubles. The net earnings for July, for August and for the current month to date indicate that the profits for the quarter ending Sept. 30 will be fully equal to those of the first quarter in the company's history, namely, for that ending June 30. The reason why this is so, is that the suspension of output by the mills affected by the strike has been fully offset by the production of other mills, and, in consequence, the tonnage of the company has been normal during the current quarter—that is, equal to the output of the previous three months. The suspension of work at various plants has permitted the making of needed repairs and improvements, and of course the company has saved the amount which it would have paid out in wages at these plants had the strike not taken place. More important than any other development growing out of the strike is the position which the company has established in relation to its employes. The points raised by Shaffer and his associates have been settled for at least a generation to come, and possibly for all time. Notwithstanding the failure of the movement, the company has unquestionably retained the good will of its employes as a whole, and of all the intelligent and fair-minded labor leaders. The only persons who are disgruntled are the officers of the Amalgamated Association, who brought disaster upon themselves and their followers. As there has been no reduction in the earnings of the United States Steel Corporation, there is obviously no excuse for changing the dividend policy of the company, and there is the best of authority for stating that no change will be made."

NEW ELEVATOR FOR MONTREAL.

The Montreal harbor commissioners have accepted the tender of J. A. Jamieson of Montreal for the construction of an elevator of 1,000,000 bushels capacity at a point in the center of the harbor. The contract price is $642,000 and payment for it will be made out of the $1,000,000 which the dominion government has agreed to lend the commissioners for the general improvement of the harbor terminals. The elevator is to be of steel and in conformity with the general plan and suggestions made by Chief Engineer Kennedy. The elevator will be built, as far as practicable, of Canadian material and is to be completed by Aug. 1, 1902. The specifications call for a pile foundation with a superstructure of fire-proof and non-perishable material. The storage bins are to be of 12,000 bushels capacity each, with no waste space between them; the total capacity of the elevator to be 1,000,000 bushels, as spouted in and not as leveled, and the shipping bins, garners, weighing hoppers are not to be counted in. The elevator is to be so constructed that it can take in grain from vessels lying opposite by means of marine legs, and from cars on two lines of tracks, and at the same time to deliver grain to as many as seven vessels, as well as to railway cars. Provision will also be made for changing the grain from bin to bin, and for mixing as may be required. The conveyors, aggregating 6,700 ft., will lead to the four sides of the two upper piers, and along the shore line, and there will be in addition marine towers and legs.

Mr. Kennedy has submitted to the commissioners a plan for the general improvement of the harbor, which has been forwarded to the minister of public works. It provides for extensions to Hochelaga and Windmill point, consisting of a system of four tracks extending the whole length of the main shore wharves, with branch tracks to the piers, and a single track across the Lachine canal for reaching wharves at Windmill point.

STEEL SHIPS—THEIR CONSTRUCTION AND MAINTENANCE.

Mr. Thomas Walton, naval architect, has written a book entitled "Steel Ships—Their Construction and Maintenance" which the Review commends to everyone interested in ship construction. This book probably would not appeal to the naval architect since it is not sufficiently technical; but to ship superintendents, marine engineers and students in general it is a most fascinating work. The plan of the book is admirable. The first chapter is a condensed description of the processes of the manufacture of steel and iron from its crude state in the form of ore to the finished product in the form of ship plates, forgings and bars, particularly noting those constituents of the material which are essential to the production of good ship steel or iron, and those which, if in excess, introduce objectionable qualities in the metal. The second chapter treats of the strength and quality of ship steel and iron, as a result of the proportions in which the various constituents referred to above are present in the metal and the particular processes through which the material passes in the course of manufacture. Then follows a general introduction to the subject of ship construction, drawing attention to the principal structural features and the alternative modes in which a vessel may be built. The largest section of the book deals in detail with the construction and combination generally of the various parts which go to make up the whole ship structure—framing, plating, stern frames and rudders, riveting, pumping and ventilation, and includes also remarks upon launching. For one at work in a ship yard who wants to note intelligently everything going on about him this book is an invaluable aid.

Capt. F. A. Fick, who was in command of the steamer Fedora when she burned, a few days ago, on her way into Ashland, where she was going to load ore, says that the vessel was beached barely in time to save the lives of the crew. They could not leave her in a life boat, as the engineer was driven to the deck in such a hurry that he did not have time to stop the engines, and the burning ship went along at full speed until she was pointed up on the shore. The fire resulted from the explosion of a lamp in the engine room in close proximity to oil tanks.

Secretary Long of the navy department has authorized repairs to the extent of $65,000 upon the floating dry dock at Havana, recently purchased from the Spanish government.

IRON AND STEEL AT THE CLOSE OF THE NINETEENTH CENTURY.

BY JAMES M. SWANK, GENERAL MANAGER AMERICAN IRON AND STEEL ASSOCIATION.*

The progress of the world's iron and steel industries in the nineteenth century, full details of which have been presented in previous reports, is well illustrated by the statistics which show the extent of their development at the close of the century and which will presently be given. Every reader of these pages is already familiar with the fact that at the beginning of the last century comparatively little iron and steel was made in any country. There was but little demand for these products. In time railroads became, as they still are, the greatest of all the consumers of iron and steel, yet the Stockton & Darlington railroad in England, the first railroad in the world to be built for general freight traffic and passenger travel, was not opened until 1825. The street railway dates from 1832. The general use of iron and steel for bridges and for ships and other vessels came later, followed by the general use of steel in the construction of large buildings, especially buildings of great height. Last of all we have the steel car for general freight purposes. These are the most prominent uses of iron and steel today, but simultaneously with the development of these leading uses there has been a constantly increasing use of agricultural machinery, textile machinery, mining machinery, electrical machinery, machine tools, iron and steel pipe, hardware, stoves, shovels, tinplates, wire, and many other articles which are made wholly or in part of iron or steel.

The railroad era began at the close of the first quarter of the nineteenth century, but it was not until the third quarter of the century was well under way that an extraordinary demand for iron and steel for railroads and for other than railroad purposes began to manifest itself in any progressive country. In our own country we built more miles of railroad in 1887 than in any year before or since. The building of iron and steel vessels received a great deal of attention, particularly in Great Britain, in the third quarter of the century, but it was in the fourth quarter that the greatest progress was made in substituting iron and steel ships for wooden ships. As late as 1868 only five iron steamships were built in one year in this country for ocean service. We have since built over 100 steel merchant vessels in one year, and we have in recent years built a magnificent fleet for the American navy, the frames and hulls and armor being of American steel. Armor plate for war ships was not made in Great Britain until after 1850, but its manufacture was not perfected in any country until within the last ten years, while the first contract for American-made armor was not made until 1887. Iron and steel buildings date from the third quarter, but they did not receive much attention from the architects and builders until the fourth quarter, while steel cars were virtually unheard of until the century was nearing its end. The manufacture of tinplates was not introduced into the United States, except experimentally, until 1890. In a word, while the nineteenth century witnessed the development of the iron age, which was succeeded before its close by the steel age, it would be more exact to say that the last year of the first quarter of the century, when the railroad era began, witnessed only the beginning of this development, and that the last quarter has seen its ripest fruits, even the last few years of the last quarter.

The rapid growth of the world's iron and steel industries in the nineteenth century, and particularly in its last quarter, could only have been made possible by substituting improved methods of manufacture for the slow and expensive methods that were in use at its beginning. The railroads of today could not have been supplied with one-half of the rails they need, indeed the half of these roads would never have been built, if the invention in 1855 of the Bessemer process for making steel had not resulted in giving to the world steel rails which would last longer and could be much more cheaply and rapidly made than the rails that were made of puddled iron. Nor could the steel that is used today in such large quantities for various structural purposes—bridges, buildings, ships, cars, etc.—have been made at all but for the invention of the Bessemer process and its companion, the Siemens open-hearth process, the latter process dating from 1864. Nor could the pig iron that has been required by the Bessemer and open-hearth processes have been supplied in sufficient quantities, not even the half of it, if reliance had been placed upon the small furnaces, the lean ores, and the charcoal fuel that were in common use less than a hundred years ago.

The modern blast furnace, with its immense blowing engines, its hot-blast stoves, its rich ores, and its mineral fuel to smelt them has been a most powerful factor in the present marvelous development of the world's iron and steel industries. It could not, however, have become this powerful agent if an abundance of iron ore and mineral fuel had not been readily obtainable. Great Britain early found at home the coke she needed for her blast furnaces; her Durham coke is not excelled anywhere; and when she began to make steel in her Bessemer converters and open-hearth furnaces she drew upon Spain and other Mediterranean countries for a large part of the ores that would make pig iron suitable for these new processes. Germany has found within the last twenty years that she could make pig iron from her phosphoric ores that could be converted into steel by the basic modification of the Bessemer process, and she has well utilized her resources. Other continental countries have built up extensive steel industries by the Bessemer and open-hearth processes, some of them, like Great Britain, largely importing their supplies of iron ore, and some of them also importing coal and coke. There is, however, a growing scarcity of iron ore and coal in many European countries, and in some the supply is being exhausted. But in the United States nature has been lavish in her supply of all the raw materials that are needed in the manufacture of any kind of steel, except perhaps the ores of manganese. Iron ores and bituminous coal are found in many states, and anthracite coal is found in Pennsylvania, all in most generous quantities. In the second quarter of the nineteenth century we successfully introduced anthracite coal and bituminous coke in the blast furnace, and in the same period the iron ores of Lake Superior were discovered. Our Lake Superior and Cornwall ores were early found to be well adapted to the manufacture of Bessemer steel by the original process, and also of open-hearth steel, and our Connellsville and Pocahontas coke are equaled in physical and chemical properties only by the Durham coke of England.

The first shipment of iron ore from the Lake Superior region was made in 1850, but it was not until 1860 that the shipments of ore from this region annually exceeded 100,000 tons. Neither Connellsville coke nor any other coke exerted any appreciable influence upon the manufacture of pig iron in this country until after 1850. These dates show how late in the last century we began to utilize the raw materials that now have a world-wide reputation. There is apparently no appreciable limit to the supply of rich and pure iron ores in the Lake Superior region and elsewhere in this country, and we have boundless deposits of good coking coal that are here and there being drawn upon to supplement the coal from Connellsville basin and the Pocahontas field, neither of which favorite sources of supply will be exhausted for many years to come. Many of our rolling mills have been greatly favored with an abundant supply of natural gas, the use of this ideal fuel having commenced in 1874, at the close of the third quarter of the century under consideration. No country in the world possesses the raw materials for the manufacture of steel in such abundance as the United States. And no country in the world has developed a more skillful or more enterprising class of iron and steel makers than our own country. Our blast furnaces, our Bessmer steel works, our open-hearth furnaces, our iron and steel rolling milles, our tinplate works, and our appliances for mining and shipping iron ore and coal are the best that the world has yet seen, and they are constantly receiving the unstinted praise of our European rivals.

While great progress has been made in the last quarter of the nineteenth century in the development of the world's iron and steel industries the most notable progress has been made in the United States. This country today leads all other countries in the production of iron and steel. This prominence in the manufacture of these articles is only in part due to the bounty of nature in providing liberal supplies of the raw materials needed; it is largely the result of friendly legislation by the general government, first, in more firmly establishing in 1861 the protective tariff policy, which has since been effectively maintained with but brief interruptions; and, second, in adopting at about the same time the policy of liberal grants of land to railroad companies. Through the operation of the protective policy the home market has been preserved for the home producers of iron and steel and of all articles made from them, and through the operation of the land-grant system, supplemented by the homestead policy, thousands of miles of railroad have been built in the western states and territories that would not otherwise have been constructed. With the building of these roads the population of these states and territories has been greatly increased, the consumption of iron and steel and of other manufactured products has been enlarged, our vast mineral resources have been discovered and developed, and the whole country has been enriched. Thousands of new farms have been opened, our agricultural products have been many times multiplied, and both home and foreign markets for the sale of our surplus crops have been easily and cheaply reached.

But many of these railroads could not have been built if our protective tariff policy had not built up our iron-rail industry in the third quarter of the century and our steel-rail industry in the fourth quarter. Until we began to make our own iron rails and afterwards our own steel rails foreign manufacturers charged us excessive prices for such rails as we could afford to import. Both the industries mentioned had at the first to struggle for their very existence against foreign competition, the early duties on foreign iron rails and afterwards on foreign steel rails not being sufficiently protective, but in the end the control of the home market was gained, the production of rails increased enormously, and the prices were steadily reduced. In the meantime, as the direct result of the home competition which the protective policy had encouraged, the production of all other articles of iron and steel greatly increased and their prices were also reduced, mines of iron ore and coal were opened which would otherwise have lain dormant, and a greatly enlarged home market for all the products of the farm was created.

After all that has been said, however, of our wealth of natural resources for the production of iron and steel, and of the influence of the protective policy and the land-grant system in promoting their manufacture, the truth of history requires that it be distinctly and positively stated that all the advantages above noted would have failed to give to our country in the last quarter of the nineteenth century steel rails and steel in other forms as cheaply and abundantly as they have been supplied if these advantages had not been supplemented by the constructive and executive abilities and the persistent energy of American manufacturers and the inventive genius and technical skill of American engineers and mechanics. The courage of our iron and steel manufacturers in entering upon new enterprises of the greatest magnitude and the skill displayed by our engineers and mechanics in attaining important and valuable metallurgical results must be a constant marvel to every student of our industrial history.

Steel rails afford a good illustration of the marvelous energy and superior skill which have been displayed in the manufacture of iron and steel in our country in the last quarter of the nineteenth century. The first experimental steel rails ever made in the United States were rolled at Chicago in 1865, but our Bessemer steel industry at first made such slow progress, owing to foreign competition and the prejudice in favor of iron rails, that the whole country made only 259,699 tons of steel rails in 1875. Soon afterwards, however, American energy and skill produced most wonderful results. In 1879 we made more Bessemer steel rails than Great Britain. In 1881 we made 1,187,770 tons of steel rails and in 1887 we made 2,101,904 tons, and we have since increased these figures. Great Britain's largest production of Bessemer steel rails was in 1882, when she made 1,235,785 tons. From 1867 to 1900, both years included, we made 33,064,467 tons of Bessemer steel rails, an average of almost a million tons a year, of which 15,668,101 tons were made in the last ten years.

*From the twenty-second annual report of the United States Geological Survey.

The Brown Hoisting Machinery Co. of Cleveland recently secured another crane contract from the British ship building firm of Vickers, Sons & Maxim, Ltd. The order calls for a 10 ton cantilever crane driven by an electric motor. The Queensland government has also ordered machinery equipment for the purpose of conveying coal from cars to ships at the Brisbane docks of the government railways. The value of these orders is said to be about $140,000.

DISPLACEMENT AND DIMENSIONS OF SHIPS.

APPROXIMATE RULES FOR THE DETERMINATION OF THE DISPLACEMENT AND DIMENSIONS OF A SHIP IN ACCORDANCE WITH A GIVEN PROGRAM OF REQUIREMENTS.

Mr. J. A. Normand read a paper before the recent International Engineering Congress at Glasgow upon the subject "The Displacement and Dimensions of Ships." He announced that the paper consisted of approximate rules for the determination of the displacement and dimensions of a ship in accordance with a given program of requirements. He said:

The problem which forms the subject of this paper is the one most frequently proposed to the naval architect; but although technical literature increases constantly, he would vainly search, in the vast amount of documents at his disposal, for any simple method of solving it. We have one, it is true, but it is not very simple, and consequently it is very seldom used. It is founded on the equation of displacement of the third degree at least. There exists another method, this one of extreme simplicity, although derived from the same equation of displacement. It offers the further advantage of showing explicitly the relative influence of each part of the program on the final result. I will try to explain as clearly as possible, since, although used by some naval architects, it is probably unknown in this country. When the plans for a new vessel are to be laid down the surest and simplest process is to take as a type one or more vessels differing as little as possible from the one to be designed—preferably existing vessels, all the data, partial weights, and results of which are well known, so that the calculations may be based on facts and not on hypothesis—and to work out the changes required by the slight differences between the programs of the old and the new ship. The possible errors are limited in that case to those that may be committed on slight differences.

If the vessel to be designed is a cargo or passenger boat, or a yacht, size forms generally part of the program. Not so in a war vessel where size and displacement must, in most cases, be reduced to a minimum. This paper deals more especially with war vessels, although the proposed rules may be used with great advantage for all kinds of ships. We will first suppose that the speed of the vessel chosen as a type is not altered, but that weights only are added or suppressed. What will be the displacement of the new ship, supposing her to be exactly similar to, and differing only by scale from, the type vessel, the water line remaining at the same relative height in order that the fineness of lines may not be altered? It is clear that the difference of displacement must be much larger than the difference of weights as calculated for the type. If, for instance, the difference of weight is positive, and equal to 300 tons, should the vessel remain unaltered she would settle down; her resistance would be increased, her lines fuller, her seaworthiness reduced, and so would the speed and the steaming distance. Accordingly, the dimensions must be increased; but as they increase so will the resistance, the horse power, the weight of hull, machinery and coals; and this further increase of weights will require a further increase of dimensions and displacement. Now, is there a simple relation between the weights first added to the type vessel and the ultimate increase of displacement? There is. According to an approximate law, first given in 1885, the plus or minus difference of displacement must be equal to the plus or minus difference of weights, as calculated for the vessel chosen as type, multiplied by a coefficient K which can be exactly determined and is nearly constant for all classes of vessels (its mean value being about 3.6), in order that the general conditions of the program may be fulfilled. Knowing by this very simple rule the approximate displacement of the ship to be designed, it is easy to calculate the dimensions, horse power, weights of hull, machinery, coals, etc., by reference to the same elements in the type vessel. At the same time, if the value of K has been calculated for the different types of vessels, in any navy, the naval architect is able to know very quickly whether the new program can be carried out without radical changes, such as adopting stronger materials and reducing the scantlings, increasing the immersion and reducing the relative height of freeboard, adopting lighter machinery and boilers, or reducing the fineness of the lines, which can be done within certain limits by a slight increase of power, provided the relative propulsive surface be augmented. The new method enables us to estimate the consequences of any of these modifications on the size of the vessel to be designed.

The rule does not apply so well to first-class battleships and cruisers, that is to say, the coefficient must then, as experience has shown, be lowered down to 2.8 and 2.5, because the law of similitude, on which it is based, does not hold good in that case. The transverse dimensions of those very large vessels remain generally constant, since the draught of water and the statical stability cannot be increased, the difference in size depending almost entirely on the difference in length. Before going further, it may be well to show how easily this rule may be applied. Let me take as a type a cruiser resembling somewhat the Diadem, with Belleville boilers, and suppose the particulars of this type to be:

Length	435 ft. 0 in.
Beam	69 " 0 "
Mean draught	25 " 3 "
Midship section	1430 sq. ft.
Displacement	11,000 tons.
Maximum speed at the above displacement	20 knots.
Corresponding indicated horse power	16,500

Let the partial weights be:

1. Weights Varying as the Displacement.

Hull, complete with accessories, but without wood and copper sheathing	4,200 tons.

2. Weights Varying as the Displacement.

Wood and copper sheathing, machinery, boilers, etc., coals necessary for steaming a certain distance at a given speed and for all auxiliary services, crew and effects, provisions, fresh water, boats	5,500 tons.

3. Weights Independent of the Displacement.

Guns, ammunition, turrets, and accessories, hoists, block-house, torpedoes, and tubes	1,300 tons.
Total, equal to displacement	11,000 tons.

$$K = \frac{11{,}000}{11{,}000 - 4{,}200 - \frac{2}{3}\ 5{,}500} = 3.51.$$

Now, what would be the displacement and dimensions of a similar vessel, where:

1. Small tube boilers are substituted for Bellevilles; the speed, steaming distance, thickness and distribution of armor, weight of guns and ammunition, etc., remaining the same?
2. Cylindrical boilers substituted for Bellevilles; the other conditions, speed, etc., as above, remaining the same?
3. Small tube boilers substituted for Bellevilles; the weight of guns, etc., reduced by 35 tons, the weight of armor reduced by 20 tons, and the steaming distance increased by 30 per cent. (assuming the weight of coals to be 2,000 tons at 11,000 tons displacement), the speed remaining the same?

FIRST PROBLEM.

The weight of small tube boilers (Normand's, for instance, with tubes 1½ in. outside diameter, instead of 1¼ in. in destroyers) is about 20 per cent. heavier per square foot of grate than Belleville's; but the combustion for the same unit may be larger in cruisers by 70 per cent. (34 lbs. per square foot of grate; that is to say, less than one-half the rate of combustion in destroyers, instead of 20 lbs.), the evaporative duty being the same, so that the relative weight of small-tube and Belleville boilers per indicated horse power is about

$$\frac{1.20}{1.70} = 0.70.$$

The weight of Belleville boilers and fittings in the Diadem (of 16,500 I.H.P., as in the type) being 748.4^t tons, the saving in weight would be $(1-0.70)\ 748.4^t = 225$ tons.

Accordingly, the displacement would be reduced by

$$225^t \times 3.51 = 790 \text{ tons}$$

and would become 10,210 tons.

Ratio of dimensions of the hull

$$\sqrt[3]{\frac{10210}{11000}} = 0.9754$$

$$\text{Power: } 16{,}500 \left(\frac{10210}{11000}\right)^{\frac{3}{2}} = 15{,}700 \text{ I.H.P.}$$

The weight of coals is reduced in the same ratio as the power, to keep the same steaming distance.

Weight of machinery, boilers, propellers, etc.: This weight being 1436.7^t in the Diadem, we have

$$(1436.7^t - 225^t \left(\frac{10210}{11000}\right)^{\frac{2}{3}} = 1153 \text{ tons.}$$

SECOND PROBLEM.

From Sir John Durston's paper, to be found in transactions of the Institution of Naval Architects, it appears that the saving in weight of boilers and machinery due to the substitution of Belleville for cylindrical boilers, working at a lower pressure, is at least 650 tons, the maximum rate of combustion being 20 lbs. per square foot of grate for Belleville and 30 lbs. for cylindrical boilers. The relative importance of the extra weight is too great in this case to allow the use of formula (2). We must take formula (7).

$$K = \frac{11{,}000}{11{,}000 - 4200 - \frac{2}{3}\ (5500 + 650)} = 4.073.$$

The displacement of the type increases by

$$650^t \times 4.073 = 2647^t \text{ and becomes } 13{,}647 \text{ tons.}$$

Ratio of linear dimensions of the hull.

$$\sqrt[3]{\frac{13647}{11000}} = 1.075.$$

$$\text{Power: } 16{,}500 \left(\frac{13647}{11000}\right)^{\frac{3}{2}} = 19{,}060 \text{ I.H.P.}$$

The weight of coals being increased in the same ratio to keep the same steaming distance.

Weight of machinery, boilers, propellers, etc.:

$$(1476^t\ 7 + 680^t) \left(\frac{13647}{11000}\right)^{\frac{2}{3}} = 2410 \text{ tons.}$$

It is prudent, especially when the extra weights are very important, to verify that no error has been made in the calculation. Here we have for the new ship:

1. Weights varying as the displacement:

	Tons.
$4200 \times \frac{13647}{11000}$	5,210

2. Weights varying as displacement—$\frac{2}{3}$

$(5500^t + 650^t) \left(\frac{13647}{11000}\right)^{\frac{2}{3}}$	7,110
3. Weights independent of the displacement	1,300
Displacement of the new vessel	13,620

instead of 13,647 tons. The difference is of no importance.

From the above it appears that the displacement of a cruiser of the type selected varies approximately from 10,210 tons to 13,647 tons; in other words, increases by one-third according as she has small tube high-pressure or cylindrical ordinary boilers working at a lower pressure, all the other conditions of the program—speed, weight of guns and ammu-

nition, thickness and distribution of armor, steaming distance, etc., remaining the same.

THIRD PROBLEM.

	Extra weights as calculated for the type. Plus.	Minus.
Boilers, as above	....	225t
Guns and ammunition	....	35
Armor	....	20
Coals, 2000t × 0.30	600t	....
	600t	280t

Increase of weights, 320 tons.

The displacement would increase by

$$320^t \times 351 = 1123 \text{ tons,}$$

and become 12,123 tons.

Ratio of linear dimensions of the hull:

$$\sqrt[3]{\frac{12123^t}{11000}} = 1.033.$$

$$\text{Power: } 16{,}500 \left(\frac{12123}{11000}\right)^{\frac{3}{2}} = 17{,}600 \text{ I.H.P.}$$

Weight of machinery, boilers, etc.:

$$(1436.7^t - 225^t) \left(\frac{12123}{11000}\right)^{\frac{3}{2}} = 1292 \text{ tons.}$$

Weight of coals:

$$2000 \times 1.30 \left(\frac{12123}{11000}\right)^{\frac{3}{2}} = 2775 \text{ tons.}$$

FOURTH PROBLEM.

We will now suppose that the only difference in the program of requirements of the vessel to be built and the above typical cruiser consists in an increase of speed of 1 knot. The fineness of the lines of the type must be increased, which cannot be done generally without reducing the displacement to suit the new speed, so that the coefficient of performance—

$$\frac{\text{Midship section} \times (\text{speed})^3}{\text{I.H.P.}}$$

should remain the same, and the power must be augmented, for the type, in proportion to the cube of the speed.

The reduction of displacement due to increase of fineness is, by formula (14),

$$\triangle D_v = -0.037 \times (1430)^{\frac{2}{3}} \times 1.00 K^t = -325^t,$$

and by formula (15)

$$\triangle D_v = -\frac{0.0286 \times 1430 \times 435 - 11{,}000}{20} = -339 \text{ tons.}$$

We will adopt a mean value of -330^t.

The weight of machinery, boilers, etc., P_m of the type being equal to 1436.7^t, we have by (9)

$$\text{Displacement of the new ship} \begin{cases} D^t = 11{,}000 + 2.51 \times 330^t + 3 \times 3.51 \times \frac{1}{20} 1436.7 \\ = 12{,}585 + 3 \times 3.51 \times \frac{1}{20} \times 1436.7^t = 12{,}585^t. \end{cases}$$

Ratio of displacement of the new ship and of the type altered to suit the new speed: 21 knots.

$$\frac{12{,}585}{11{,}000 - 330} = 1.180.$$

Ratio of linear dimensions

$$\sqrt[3]{1.180} = 1.057.$$

Ratio of indicated horse power and of weight of machinery and boilers by (12)

$$\left(1 + \frac{3}{20}\right) (1.180)^{\frac{2}{3}} = 1.284.$$

From the above we see that, in a cruiser of the type considered, an addition of 1 knot to the 20 knots of the type vessel leads to an increase of about 18 per cent. in the displacement and of 28 per cent. in the power, the thickness and distribution of armor, steaming distance at a constant speed, and weight of guns, ammunition, etc., remaining the same. The increase would be still greater if the steaming distance were partly measured at a speed proportional to the maximum. It ought to be so, since it is useless to give a very high speed to a ship if she is never to make use of it. No quality is more expensive than speed.

The few problems which we have solved by the new method are sufficient to show how easily it may be applied. It elucidates very simply a question which most people and even some naval architects do not clearly realize—the extreme importance of lightness in a warship. How often have we not heard during that everlasting discussion about cylindrical versus water-tube boilers, that "to save a few hundred tons weight it is dangerous to change a well-known type of boiler for a more expensive one, requiring far greater care in manufacture and working." Even if it were so, it ought to be known that the saving is not those few hundred tons weight, but about 3½ times this amount. The immense advantages resulting from a reduction in the weights of war vessels will certainly lead sooner or later to the adoption, not of small water-tube, but of mean water-tube boilers of some type or other capable of standing a high rate of combustion. Even this alteration will not be sufficient if the race for speed continues.

Steel of high tensile strength will be needed for the hulls of large vessels; but the greater part of the advantages to be derived from its use will be lost until equally strong steel, not hardening when riveted hot, can be commercially and surely produced.

In this paper I have dealt only with large vessels, the speed of which corresponds always to the descending part of the curve of the coefficients of performance. The principles laid down may equally well be applied to small high-speed vessels, such as destroyers and torpedo boats; but it must not be forgotten that their maximum speed always corresponds to the ascending part of the curve, so that the fineness of the lines need not be altered when the maximum speed changes, and that the power may be proportioned to the square of the speeds. We have seen that, on the contrary, in large vessels the power varies as the cube of the speed when the fineness is altered to suit the new speed, or to a higher power if the fineness remains the same. Extreme speed is relatively less expensive in a small vessel than in a large one.

CLASSIFICATION.

Though much is heard from time to time in adverse criticism of Lloyd's, it is a standing tribute to this premier classification society that so much of British and other tonnage is built under the ægis of its rules. It is, however, a fact, the significance of which is not generally recognized, that certain lines do not build according to Lloyd's rules, nor to those of the Bureau Veritas, or to the British Corporation or other classification society, and yet their ships are accepted by underwriters as being as safe and strong, and as well fitted for their work as ships can be. It is not, however, every firm which has the courage and the opportunity of building unclassified ships, and hence classification societies perform a useful and valuable work. As Mr. Walton points out in his work on steel ships, the strength of vessels should be regulated by their proportions and maximum displacements, provided that enough freeboard remains to ensure sufficient stability and a condition of general seaworthiness.* Classification societies, therefore, have to take into consideration the purpose for which a ship is built. This they do, but at the same time they have, up to the present, failed to realize that a ship which is built with a view to carry cargo may seriously injure herself by making a voyage with nothing in her holds. Since ships do make voyages in exceedingly light trim, it should be realized by all these classification societies that modern vessels may be called upon to carry anything or nothing and should be constructed accordingly. Though the societies decide of what strength, etc., a vessel shall be constructed, it should be remembered that the government, or rather the board or trade, are supremely responsible for the seagoing condition of all British vessels, and in fact, foreign vessels sailing from British ports. Naturally the most important part—the climax of the work done by the classification society—is the affixing of the maximum load-line, as this is tantamount to a declaration that the vessel is so built that she is strong and seaworthy enough to accomplish an ocean voyage when immersed to the mark placed upon her sides. Where a ship is taken in hand by a society from her inception, the supervision exercised is, or should be, of the most real and painstaking character. The plans must be according to the book of rules; scantlings and special structural requirements must be indicated and approved; even the steel of which the ship is constructed must be tested and approved. Llody's Bureau Veritas and the British Corporation have much the same standard respecting the qualities of iron and steel for ship building purposes. Samples are tested at the steel works in the presence of the society's surveyor. Should the tests be satisfactory the plates and beams and angles are stamped with the hallmark of the particular society whose surveyor witnesses the qualitative test. These trials are, or are supposed to be, of a most exhaustive nature. The tensile strength, transverse strength, ductility, elasticity, must all be tested, and should the portion experimented upon fall short of the standard, the lot should be summarily rejected. It is rarely, however, that the steel passed as suitable for ship building purposes is of doubtful character. It more frequently happens that it is the workmanship put into the vessel which is inferior and escapes detection. It is only on this ground that the fact that so many new and high-classed vessels have to pay a lengthy and expensive visit to the dry dock after making a first voyage can be satisfactorily explained. While the ship is constructing her engines are built under the superintendence of the society's engineers, and at length the finished vessel, with thickness of masts, weight and strength of anchors and chains, etc., all determined by the books of rules, is ready for delivery. She may be built on a scale of strength which entitles her to a place in the highest class of the society, but it does not follow that she keeps that class. Naturally, she deteriorates, and unless steps are taken to maintain her in much the same original strength and efficiency, she will be assigned a lower class, and will then have a lower load-line and a greater freeboard, the reason being that she can no longer carry the deadweight she formerly did. Lloyd's rule is that vessels classed by them shall, at intervals of four years, be subjected to special surveys, when, if their structural strength is maintained, they retain their assigned class. Here, again, the societies have rules laying down the standard of strength to which a vessel shall attain before she is officially allowed to keep her class. On the subject of these special surveys, Lloyd's rules state as follows: "If a vessel is at a port in the United Kingdom after the expiration of prescribed period for survey, and is not subjected to the special survey then due before leaving the United Kingdom, the word 'expired' is inserted against her character in the register book; and in no case will a vessel be allowed to retain her class, if she has not been subjected to the whole of the requirements of the requisite special survey within twelve months from the date when the survey became due." These examinations, however, under special survey are not in all cases the thorough and searching examinations they should be. It is quite easy to understand that the owners of the vessel which must be subjected to a special survey are, in many instances at least, desirous of spending no more money on the ship than is absolutely necessary. Much, therefore, depends upon the surveyor. It is true that he has the rules to guide him, but these have to be interpreted, and, to put the matter mildly, the human standard is an exceedingly variable quantity. On the other hand, there are some surveyors who work too much by rule of thumb and by insisting on minute attention to details which may be relatively immaterial, overlook some point of structural importance which should be a factor in determining the amount of repairs and strengthening necessary to enable the vessel to maintain her class.—Syren & Shipping, London.

*This book has just been issued from the press and is for sale by the Marine Review Pub. Co.

CHART-ENGRAVING MACHINES.

THE NAVIES OF GERMANY AND JAPAN PURCHASE A COMPLETE SET OF THE MACHINES USED IN THE HYDROGRAPHIC OFFICE IN WASHINGTON.

Messrs. Queen & Co., Philadelphia, have just completed a complete set of hydrographic chart-engraving machines for use in the hydrographic office of the Imperial Japanese navy, identical with those now in use in the hydrographic office at Washington. These machines are the invention of Vincent L. Ourdan, who has for twenty years been the chief engraver in the hydrographic office, or was until recently when he resigned to leave for Japan to install a complete set of his machines there. Attention to these remarkable machines was first called in the naval edition of the Marine Review, issued in September, 1899, and almost immediately thereafter Ourdan received overtures for a set of them from the German and Japanese navies. It is gratifying to note now that Queen & Co. have received orders from both of these governments for a complete set of the machines. The American rights to the machines were purchased by the United States government from Ourdan but beyond that the government never took recognition of his distinguished services. His position in the government service was never advanced. These machines have more than trebled the output of charts by the hydrographic office.

The machines, of which there are six, consist of a sounding-engraving machine, a combination of tinting and border-engraving machine, a border-subdividing machine, a border and scale-shading machine, a compass-engraving and lettering machine and a multi-point divider. Until now the United States has been the only nation that has done its engraving by machinery. The machines operate as follows: When the drawing of the chart is finished it is turned over to the engraver, who, after laying down the projection from the computation furnished for that purpose, proceeds to engrave the body of the chart. This machine is 5 ft. long and 1 ft. wide, consisting of a two-rail track, on which slides a carriage about 1 ft. square, which carries a graver that cuts a line exactly like a hand engraved line, only more uniform. This graver is fed transversely by a micrometer screw. The machine is then set off on the plate and a series of lines are engraved so closely together as to make when printed a solid black line. If the border is to be divided into longitude and latitude scales the degrees are laid off and they are in turn subdivided into six minute spaces by multi-point dividers, made in the form of a hollow cylinder, through the opposite sides of which are cut in opposite directions a series of radial slots. A post of lozenge or square section is then inserted in the cylinder from end to end, on which is strung a series of points, each end of which passes through the slots, and when the post is turned the points recede from or approach each other, there being eleven points. When those on the ends are in coincidence with the limits of the degree the intermediate points instantly subdivide the degree into ten spaces. Each alternate degree is then shaded. This is done by another machine, which is composed of an annolong base of about 5 ft. by 2 in., on which travels a cross track. A carriage rides on this cross track, which carries a rising and falling point. The machine is then set parallel to the border and by turning a handle a series of wheels and cams is set in motion, which by one operation first moves the point forward the required distance, then lowers it to the plate. The point is then drawn back, cutting a short line. The point is then raised and moved forward again ad infinitum. By another operation the carriage, after each line is cut, and while the point is raised and is moving forward, is moved laterally the required distance. This gives a series of short parallel lines. The topographical engraver then takes the plate and engraves all the topographical features on the chart. It is then passed to the next engraver who proceeds to engrave the compass roses. This is done by a combination machine consisting of an annular base, on which rotates an annular ring on a series of about 200 hardened steel balls, such as are used in bicycles. On this ring is first fitted another ring bearing the compass-cutting mechanism, which cuts automatically all the different lengths of lines, the operator having only to move the arm forward or backward. The following operation ensues: First, by a ratchet on the arm the turret at the back is rotated, bringing either its periphery or a slot of the required length to the front. Second, a lug at the arm then lowers the point to the plate and another lug engages the tool carrier, drawing the same backwards, cutting the line, the length of which is regulated by a projecting point which strikes against the periphery or enters a slot of the turret. On the forward stroke the first operation raises the point out of the cut line and from the plate; the second carries the tool forward, while at the same time the ring bearing the carrier is rotated one degree. This operation is continued until the circle of 360 degrees has been engraved. The machine is then adjusted to cut the second series of lines representing the 128 points of the mariner's compass, after which, by adjusting the annular ratchets, the machine is then adjusted to the required magnetic variation and the same operation of cutting is repeated. The ring bearing the compass-cutting mechanism is now removed and another ring bearing a lettering device is substituted, consisting of an upright bearing, a longitudinally rotating pattern disc, having engraved thereon, on a large scale, such numerals and letters as may be desired, a rising and falling universal joint, through which passes the engraving point, at one end of which is the stylus, at the other the tracer, which, following the channel of the engraved pattern above, engraves on the plate below an exact reproduction in miniature of the pattern, the size of the production being regulated by raising or lowering the universal joint, which is on the principle of a fulcrum.

The plate then goes to the sounding-engraving machine. This machine has two side tracks, each 6 ft. in length with interior racks; a cross-head, 6 ft. in length, traversing the side tracks by means of a shaft, on each end of which is a pinion engaging the racks of the side tracks. On this cross-head are two carriages connected at the top of one and bottom of the other by a steel tape. The one carriage carries the lettering device of the same pattern as that on the compass-machine and controlled by an endless screw with ratchet at one end, operated by a lever-handle carrying a pawl. The movement of this carriage is transmitted in reverse to the other carriage which bears the stationing point by means of the steel tape. Thus these carriages move east and west in opposite directions to each other by means of the endless screw, and north and south simultaneously by the movement of the cross-head; and so any position on the chart can be instantly assumed. Now the plate is fastened to the table under the engraving carriage and the drawing in the corresponding position under the stationing point, so that when the stationing point is directly over the center of a sounding, the engraving point, when perpendicular, is directly over the corresponding position on the plate. By rotating the pattern disc the desired numeral is brought to the front, the tracer is lowered into the engraved pattern on the disc, the stylus is lowered and by means of its weight pressed into the plate, and by following the channel of the pattern the numeral is reproduced on the plate. If the sounding consists of several figures, the desired spacing is obtained by a limited turn of the endless screw, and the second, third or fourth figure engraved in proper order. The plate then goes to the letter engraver, after which the land surface is tinted by the tinting machine, which is composed of a long narrow track, on which runs a carriage bearing a small roulette of 100 points to the inch, which when drawn under weight across the table makes a dotted line, the lines being 1-100 of an inch apart. This is the last operation and the plate is ready to be printed from.

DOMINION IRON & STEEL CO.

The annual report of the Dominion Iron & Steel Co., which is building up an immense steel plant at Sidney, Cape Breton, and also developing iron mines near the steel works, shows that there has been expended up to the present time $9,571,054.41. In his report to the president, General Manager Moxham says:

"We have been considerably disappointed in the delay in completing the plant; nevertheless two of our blast furnaces are now in operation and the other two so near completion that their operation will not be long delayed. The 400 coke ovens have been completed. The blooming mill has most of the machinery in place and everything needed to complete it is on the ground. The open-hearth plant is being energetically pushed by the contractors, and at the present rate of progress will be completed during the early fall. The piers and unloading plants are practically completed. We have gone far enough in the development of our ore mines at Wabana and in the working of our coke ovens and also in the development of our limestone to speak with certainty as to these three items. There only remains the cost of labor, and with a thoroughly modern design of plant and the very satisfactory way in which the new machinery has so far dropped into line in its practical working, I think we can rest assured that there is no doubt as to our labor costs."

MORE SUBMARINES.

The new submarine torpedo boat Porpoise was launched a few days ago from the Crescent Ship Yard, Elizabethport, N. J. Miss Fanny Maxwell Moore, daughter of Charles H. Moore of Brooklyn, performed the christening ceremony, and a number of prominent naval officers were present for the occasion. The Porpoise is one of five Holland submarine boats built for the United States government. Her length is 64 ft. 4 in., and her beam 11 ft. 9 in. Her displacement when submerged is 120 tons. When steaming along the surface she is to be propelled by a 160 H.P. gasoline engine, and when entirely submerged by a 70 H.P. electric motor. Her estimated speed will be 8 knots an hour on the surface, and 7 knots an hour under water. Five Whitehead torpedoes constitute her armament, and these can be discharged whether the vessel is submerged or not. The conning tower, the only part always to be exposed above water, is of Harveyized steel 4 in. thick. It has sights in eight directions. The crew of the Porpoise is to consist of seven men.

The torpedo boat Nicholson was launched directly after the Porpoise and christened by Mrs. O. H. P. Belmont. This boat is 175 ft. long, has 165 tons displacement and of 3,500 I.H.P.

SHIP YARD NOTES.

Gardner & Cox of New York have received from Col. John Jacob Astor a commission to design and superintend the construction of a twin-screw steam yacht of 227 ft. water line, 32 ft. beam and 13 ft. draught.

The first vessel constructed at Bangor, Me., since 1891 is to be built this winter at the yard of E. & I K. Stetson for Capt. Charles Trask of the schooner I. K. Stetson, and others. The vessel is to be a four-masted wooden schooner of about 900 tons.

The Merrill-Stevens Engineering Co., Jacksonville, Fla., is at work upon two steel steamships to be used in the river service in North Carolina.

The Kelley, Spear Co., Bath, Me., has closed a contract to build a four-masted wooden schooner of about 600 tons to be completed in January. It has not yet been announced who the vessel is for.

CRAMP STEEL CO. AT COLLINGWOOD.

Work on the foundations for the five buildings for the Cramp Steel Co., Collingwood, Ont., is being pushed along with all possible speed. The plans call for a machine shop 62 ft. by 45 ft., a boiler house 200 ft. by 60 ft., a blooming mill 206 ft. by 50 ft., and a merchant bar mill 190 ft. by 70 ft., to be made with stone foundations, wooden and structural iron sides and to be covered with corrugated iron roofing. The company is also laying out two 30-ton open-hearth furnaces. The company estimates that the plant will cover thirty acres. Tenders for the construction of docks and approaches are to be asked for in the near future and the company expects to be ready for business by the opening of navigation next year.

Strohman propeller wheels, manufactured by the Strohman Iron Co., West Superior, Wis., are highly commended in letters from several vessel men of the great lakes. The company has published these letters in a pamphlet, which they are now distributing. "In this wheel," says the pamphlet, "the principle is reversed. Instead of adjusting the wheel to the water, the water adjusts itself to the wheel. Every inch of the blade is a working surface. The casting is much lighter for the same strength of material. The diameter is decreased from 6 per cent. to 10 per cent.—the blades are narrower. The work of turning surplus metal in the water is reduced to a minimum."

JAPAN'S MERCANTILE MARINE.

From the London Times.

In practice the ship building encouragement law which was placed upon the Japanese statute book in 1895 has afforded genuine satisfaction, and the government of Tokio may point with pride to the extraordinary expansion of naval transport facilities that has accrued. The terms offered to ship builders were, briefly, that in respect of iron or steel steamships of 1,000 tons and upwards, built under the supervision of the ministry of communications by a Japanese subject or company composed exclusively of Japanese subjects, and in other ways complying with the regulations, the owners were to become entitled to receive from the exchequer a sum in each case equal to 20 yen—i. e., £2 per ton for the hull plus 5 yen for each unit of horse power employed in propulsion. It was stipulated that no foreign material save that specified by the ministry of communications should be used. A smaller class of vessels, which it was foreseen would be needed to navigate the Yang-tsze-kiang up to the Japanese settlement at Chung-king, and having a tonnage ranging from 700 to 1,000 tons, were to be granted 12 yen per ton for the hull. The bounties on steamship construction thus offered have since been earned by three steamers of more than 6,000 tons built at Nagasaki, one of which—the Awa Maru, 6,309 tons—is the largest merchant vessel Japan owns, and between forty and fifty ships of less burden, including two of 2,000 tons each—the Taitei Maru and the Taisui Maru—for the Yang-tsze river service, which are practically ready to be placed on the berth for Han-kau. The Daigi Maru, running between Formosa and Hong Kong, 2,600 tons, is another of the Japan-built craft, wholly constructed at Osaka, at the new yard of the Osaka Iron Works & Ship Building Co. The Iyo Maru, nearly ready for launching at Nagasaki, is to join the Kaga Maru, now completing at the same yard, and the Shinano Maru, which arrived in the Thames a month ago and has since taken the Japanese bluejackets round to Barrow-in-Furness, in the establishment of a fortnightly Japanese service between Hong Kong and Seattle, Wash. Three Japanese ships are maintaining a monthly service on that route already. The Tokachi Maru has been built at Kobe, and is a steel screw steamer of 1,700 tons, classed A1 at Lloyd's—the company which constructed her, by the way, having just paid a dividend of 12 per cent. despite the prevailing depression of trade arising from the situation in China.

The navigation subsidy law further provided encouragement to owners of vessels of 1,000 tons and upwards flying the Japanese flag, such being the property of a Japanese subject or company consisting exclusively of Japanese subjects, on compliance with the government terms relating to naval transport. These were that on certain conditions a subsidy should be granted of 25 yen per ton per 1,000 nautical miles, run at a minimum speed of 10 knots, to ships of 1,000 tons, and 10 per cent. additional for every 500 tons additional displacement. Higher speed than 10 knots was to be rewarded by 20 per cent. per knot. The bargain to be made with the government was that the ship might be requisitioned for public purposes on payment of a suitable sum; that she should carry navigating cadets at her owner's expense; that foreigners should not be employed in her without the ministry sanction; and that when required she should carry the mails and postal employes. It was also a condition that the ships should not be more than 15 years old, or have been more than five years in Japanese hands. The subsidies were to be payable in full for the first five years only, and at a reduced rate during the next fifteen years, but the ship might not be regarded as free of liability to serve until twenty-three years in all should have elapsed. Roughly, these figures show that the government was ready to afford aid in the construction of a ship of, say 5,000 tons, to the extent of £10,000 for her hull and £5,000 for her engines, provided that they were of 10,000 H.P. For every voyage made from Yokohama to Antwerp and back, via Marseilles and London, moreover, such a vessel would earn a subsidy from the government of a little over £200.

To judge of the effect that this system of bounties has had since 1895 in adding to the strength of Japan's mercantile marine it is only necessary to glance at the subjoined table:

Steamers.	1886.	1893.	1894.	1895.	1899.
Under 500 tons.....	178	308	335	373	549
500-1,000 tons	19	36	39	41	56
1,000-2,000 tons	20	43	46	58	65
2,000-3,000 tons	10	11	29	40	47
3,000-5,000 tons	—	2	11	15	20
Over 5,000 tons	—	—	1	1	16
	227	400	461	528	753
Total tonnage 92,398	167,490	263,929	331,374	498,376	

It will be observed that before the war with China, which began in 1894, Japan had but 400 steamers, and those, with two exceptions, were under 3,000 tons. Three-fourths of the total number were coasters under 500 tons. But the need of transports for conveyance of her troops to Korea, Leao-tong and Shan-tung occasioned an immediate increase of nearly 100,000 tons in the total of her steam mercantile marine and the total sprang to upwards of 263,000 tons in the first year of the war. In 1895, after it had ceased, the total had risen to 331,000 tons; and then the operation of the subsidies and ship building encouragement programs combined to force up the figures to what they are today—considerably above 500,000 tons and close upon 800 vessels. Since 1886 the tonnage has quintupled and the number of ships much more than trebled. The tonnage, indeed, has doubled in the six years that have elapsed since the war.

The sailing craft have increased in even a larger ratio, for whilst in 1890 these vessels numbered but 304, with a tonnage of 40,267, by the year 1899 the figures were 2,783 vessels with an aggregate tonnage of 270,162. Of these it is true that a portion were only semi-European in design, but they were latterly classed with the ships of purely foreign build, and deservedly so, as being superior to the native "junk," which in these calculations was nowhere taken into account. It is to be noted that not only have the Japanese ships increased in number and tonnage in a striking degree, but the material used in their construction has essentially changed in character. Ten years ago out of 352 steamers no fewer than 245 were entirely wooden craft, and only eleven were of steel. In 1899 500 were wood, but 116 were of steel and 123 of iron, thirteen being composites.

The tremendous impetus given to Japanese ship building as one effect of the war with China is a factor which must not be overlooked in framing any estimate of the potentialities of the "Great Britain of the East." The table given above shows that she has 150 steamers of 1,000 tons and upwards—thirty-six of them being substantial ships of more than 3,000 tons—and practically these are all available for the transport of men and munitions of war in an emergency. It is true that many of them are engaged in maintaining trade connections with Europe, America and Australia, and could not be taken off without complete dislocation of commerce; but as was shown in the recent troubles in China, the smaller craft would suffice amply to convey a powerful army to any threatened point, such, for example, as Formosa, or the extreme north, and the largest mail boats need not be interfered with, unless for use as armed cruisers. If the growth of an eminently serviceable mercantile marine is to be accepted as an index to the general prosperity of a nation, then has Japan good reason to be contented with her rate of progress.

REORGANIZED FIRE-PROOFING WOOD COMPANY.

The organization of the United States Non-Inflammable Wood Co. with a capital stock of $2,250,000 is announced in New Cork. The directors of the company are: Robert Oliphant of Ward & Oliphant; Charles Converse West, banker and broker; James D. Raymond of A. A. Vantine & Co.; E. A. Bradley, president of Bradley & Currier Co.; Charles H. Stone, expresident J. P. Hale & Co.; George C. Currier, president Electric Fireproofing Co. and Hayden Horsey, manager Queen Street bank and Dominion bank, Toronto. The purpose of the company is to acquire the patents and patent rights for the United States for rendering wood non-inflammable, now owned and operated by the Electric Fireproofing Co. of New York, which company has been in operation for the past four years. The new company is virtually a reorganization of the business now carried on by the Electric company. The electric fire-proofing process is operated by the following named companies: The Newport News Ship Building & Drydock Co., Newport News, Va.; the Union Iron Works, San Francisco, Cal.; the Electric Fireproofing Co. of Canada, Ltd., Montreal, and the British Non-Flammable Wood Co., Ltd., London. The product has been used in the construction of more than sixty battleships, cruisers and torpedo boats in the United States navy, and in numerous battleships in the navies of Great Britain and Russia and other countries. It is the purpose of the company to erect in New York a six-cylinder plant having a capacity of 15,000,000 ft. a year.

NEW PIPE CUTTING PLANT.

Crane Co., New York, a branch of Crane Co., Chicago, manufacturers of valves, fittings, pipe, etc., has added to its already large quarters a plant for the cutting, threading and flanging of large and small pipe and for pipe bending. It is located at 497 to 505 Cherry street, connecting in the rear with the pipe storage warehouse at 742 and 744 Water street, and being opposite the main warehouse at 490 and 502 Cherry street. As the location is directly on the East river, and very easily accessible to lighters, it is in an exceptionally convenient location for handling heavy work.

The building is 125 by 100 ft. The main shop, devoted to the cutting, threading and flanging of large pipe, is 110 by 63 ft. The rear shop is devoted to the handling of small pipe and to pipe bending. A paved driveway runs through the building at one end from the pipe storage yard to Cherry street. The pipe is brought from the yard to the machines on trollies with air lifts and when ready for shipment is loaded into the trucks in the same way. There are thirteen pipe machines in the main shop, and in addition to these there are machines for screwing up flanges of all sizes and facing lathes for refacing flanges after they are screwed on. Its convenient location and large and distinctly modern equipment make this shop fully equal to any shop in the east for the handling of pipe work.

WOULD NOT GO TO SEA WITHOUT THEM.

Men in charge of the army transports are certainly very earnest in their praise of the releasing hooks for detaching boats which are made by the Standard Automatic Releasing Hook Co. of 17 State street, New York. A. H. Laffin, master of the transport Burnside, says in a letter from the Philippines to the New York company:

"I have the honor to inform you that after giving your releasing hooks and gear a thorough trial, I take pleasure in stating that they are the best I ever saw. Your hooks and gear have been given great tests, as this transport having been for the past eight months laying cable, it has been necessary to lower our boats both night and day, almost continuously. They have always worked like a charm, and I would not go to sea again on any ship that did not use them, even if I had to buy them myself. I feel it my duty to recommend them to every ship."

The Cleveland-Cliffs Iron Co. has decided to abandon operations at the Michigamme mine. About 50,000 tons of ore have been won under the present management, but the cost of operation has been excessive.

For navigation charts apply to the Marine Review.

HELEN MINE AT MICHIPICOTEN.

AN EXHAUSTIVE REPORT IS MADE UPON IT BY THE ONTARIO BUREAU OF MINES.

The latest report of the Ontario bureau of mines contains a paper upon the subject "Iron Ranges of the Lower Huronian" by Dr. A. P. Coleman. The paper is of especial interest because it deals exhaustively with the Helen mine, which is now being operated by the Clergue interests of Sault Ste. Marie. Dr. Coleman says in part:

"During the year 1900, the work of developing the mine has been carried on by open cuts, drifts and diamond drill borings. The ore deposit is now better outlined than before and proves to be of very large dimensions. As stated by Capt. Williams, it is 1,090 ft. in greatest length (from northeast to southwest) and has a width over all of 400 ft.; and it reaches, as shown by borings, 188 ft. below lake level and rises as a hill 100 ft. above water, a thickness of 288 ft. in all. A drift run into the hill toward the east passes first through loose materials, sand with boulders, some of them banded sandstone, others of the impure siderite of the hill rising 450 ft. to the east, the boulders being changed in various degrees into ore, some of them completely so. About 40 ft. in the drift there is a band of white or gray sand, soft and very fine, 10 ft. wide, sometimes passing into the banded sandstone mentioned before, but good ore occurs beyond this almost to the end of the tunnel, 260 ft., when pyritous chloritic schist was encountered and the drift was stopped. The ore from the drift is partly soft and partly hard, and most of it is of good quality.

"The character of the ore is much better shown now than before the development, and it has been proved to consist largely of red hematite, both soft and hard, in addition to the brown ore. The latter is sometimes beautifully stalactitic and concretionary, and occasionally has brilliant blue and green colors, due in all probability to thin films of oxide. The yellow variety of limonite occurs also, though not in large amount, and it is said that analyses of the fibrous, stalactitic ore prove it to be goethite rather than limonite. In general the only impurities in the ore visible to the eye are portions of the sandstone mentioned before, though at times small crystals of clear quartz occur also; and the only source of sulphur observed seems to be the pyrites in the unchanged carbonate which occurs as boulders in part of the ore. There is less of the 'blue' ore, or hard steel gray hematite, to be found at the Helen mine than in most of the Marquette or Vermilion range iron mines; and the considerable amount of limonite present suggests a likeness to the Mesabi ores of Minnesota. The fact, too, that no jasper, but only sandy-looking materials, occur near the ore body, points somewhat in the same direction.

"The ore from the Helen mine contains too much phosphorus to be of bessemer grade, and so does not equal the best of the ores from Michigan or Minnesota, but it stands high among the non-bessemer ores. Analyses of the core obtained in boring 188 ft. below Boyer lake average as follows: SiO_2, 2.28; Fe, 63.83; P, 0.09; S, 0.03. Some assays gave as high as 69 per cent. of iron, and the lowest amount of phosphorus found was 0.02 per cent.

"The source of the iron has been made clear by the later explorations, since diamond drill cores obtained from various depths consist of siderite, as shown by Mr. Clergue's chemists. One from a point between 129 and 142 ft. down yielded 36.54 per cent. of iron, equivalent to 75.69 per cent. of carbonate of iron, and is therefore an impure siderite. Another specimen contained only 60.39 per cent. of carbonate of iron and 29.61 per cent. of insoluble matter, mainly silica; and a third, said to consist of orthoclase with siderite, gave only 9.55 of carbonate of iron. The singular rusty rock at the outlet of Boyer lake, brownish gray and compact and containing much pyrite when unweathered, turns out to be siderite also; and the same is true of the rock forming much of the hill which rises 450 ft. above the same lake toward the east. This in fresh samples below the brown crust of limonite produced by weathering, is bluish gray, compact, and contains a good deal of pyrite; and on analysis turns out to be an impure siderite.

"In 1900 about 62,000 tons of ore were shipped to Midland and other points before the close of navigation, almost as large a quantity as had been mined in the whole of Canada in the previous year. The town at the harbor stands on a terrace of sand and stratified clay near the shore of Lake Superior; and the same blue clay is said to underlie part of the harbor, giving excellent ground into which to drive piles for the ore docks, etc. The clay rises in one of the railway cuttings about 100 ft. above the lake, and goes 160 ft. below it, as proved in driving piles; so that it is present in unexpected amounts. All the terraces inland, as near the Post and Wawa, are of sand, as mentioned in previous reports.

"Mr. E. V. Clergue states that the explorations carried out by the company since the previous year have shown that the iron range is interrupted for two miles, between Hematite hill and Eleanor lake; but then goes on to Red lake near Park's lake, where the Josephine mine is being developed. This mine appears to be of much promise, and important deposits of ore are reported also from a new range found by Prof. Wilmott north of Paint lake and west of Iron lake near Dog river. Under Prof. Wilmott a series of explorations has been started to determine the economic value of the region, and to make a geological map of the country to be served by the Algoma Central railway and its branches.

"The iron-bearing rocks at the Helen mine have a width over all from north to south of 800 to 1,000 ft., as shown east of Boyer lake, which corresponds fairly with that given for the Marquette and other ranges, of about 800 ft., though this width is sometimes exceeded in the American iron regions. The rocks stand nearly vertical, so that the width makes also the thickness; and in general the iron-bearing band runs parallel to the schistose rocks on each side, though it has sometimes been shattered and brecciated, and near Sayer lake has been bent into a nearly vertical fold. Up to the present there is little to show which side of the range is the base, i. e., in what order the strata were laid down; since, unfortunately, the schist conglomerate representing the basal bed of the Upper Huronian, shown at the harbor and for some miles along the railway,

has not been traced all the way to the ore deposit, so that its relation to the latter is unknown. If the two were found in contact the conglomerate would of course be uppermost, and the succession would probably though not necessarily be such that the bed beneath it would be the highest in the Lower Huronian. The only point suggesting a solution of the problem is the fact that most of the sandy rock interbanded with iron ore is on the north side and most of the siderite on the south side. As it has been found in the Penokee range that the purer iron carbonate occupies usually the upper horizons and the cherty rock the lower ones, there is some probability that the southern side was originally uppermost. The succession from north to south as far as can be judged at the mine begins with a series of ridges of green schist at least one-eighth of a mile broad, followed by 400 or 500 ft. of granular silica interbanded with iron ore and probably about 400 ft. of siderite beneath the ore deposit. South of this comes a ridge of felsite schist turned into 'paint' rock and 'soap' rock next the ore, with various green schists, probably sheared eruptives, beyond.

"The section across the top of Hematite mountain, as worked out last year, is somewhat different, but the wooded hilltop gave only a poor exposure, and the costean pit examined did not run the whole way across. The section begins with the same sandstone and chert, banded with iron ore of undetermined width, followed by 75 ft. of a partly schistose greatly weathered brown rock, an impure siderite with silica and also sericite or talc; then 24 ft. of siderite with some bands of green schist, followed by 54 ft. of nearly pure siderite, showing no cleavage or bedding, in all 103 ft. of more or less pure siderite. Next comes a thin band of granular silica, succeeded by a few feet of greenish and yellowish-brown schist and 150 ft. of soft green schist, the two latter rocks probably representing the felsitic and chloritic schists of the section at the east end of Boyer lake. The different members of the band vary in thickness from point to point, and the length of the siderite as seen is not more than a mile and a quarter in a direction about east and west from the east end of Hematite mountain, which is about three-quarters of a mile long, to a little beyond the west end of Sayer lake. It should be mentioned that the width of the sandstone and siderite at the west end of Sayer lake was estimated at 1,000 ft., but it was interrupted near the middle by 200 ft. of green schist with some slate. The south shore of this lake is partly formed by a large mass of pyrite, mixed with sandy grains, apparently a greatly modified variety of the granular silica. Two miles to the east of Hematite mountain and south of Lake Eleanor the siderite is found again but is apparently absent for the two miles between. Here also it is exposed on a steep hill along with iron-bearing silica, the siderite showing as a narrow band on the face of a cliff. It is of interest to note that black carbonaceous shale is exposed to the south of this hill as in some of the American iron ranges."

The Marine Iron Works, station A, Chicago, have just issued a new 48-page catalogue descriptive of their product, which they will send free on receipt of request. A separate pamphlet issued by the same company, devoted especially to "River Navigation" (shallow water stern wheel boats), will also be included if asked for. 1

A settlement has been reached by the Puget Sound Dry Dock Co. with its striking machinists and the men have returned to work.

CHAIN FOR SALE.

About 400 ft. second-hand Hayden's stud-link cable chain. Has been little used, shows no wear and will be sold cheap. Address, The Fitz Simons & Connell Co., 1012 Tacoma Bldg., Chicago. Oct. 3.

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The package freight steamer Avon, which was recently slightly damaged by fire, now lying in the port of Buffalo, is offered for sale. Would make an excellent steam barge for the lumber trade. Inquire of H. C. French, president and general manager, the Union Transit Co., Buffalo, N. Y. Sept. 26.

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Garlock Packing Co.....Palmyra, N. Y.
Jenkins Bros.....New York.
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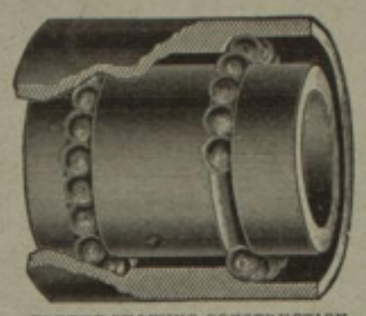

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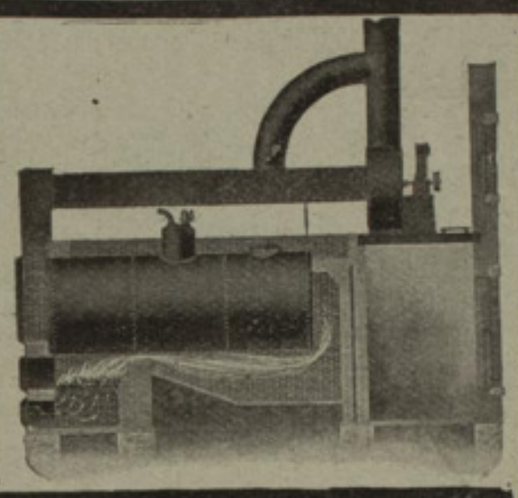

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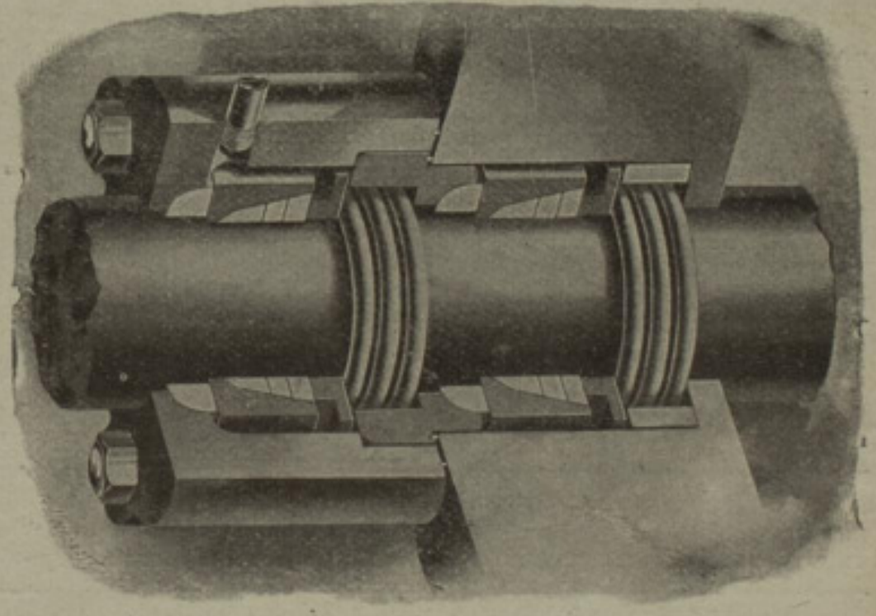

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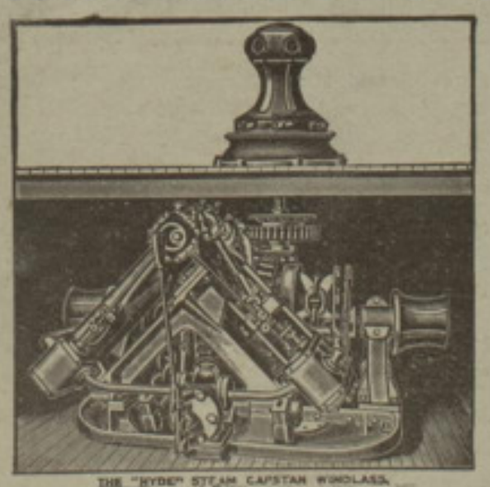

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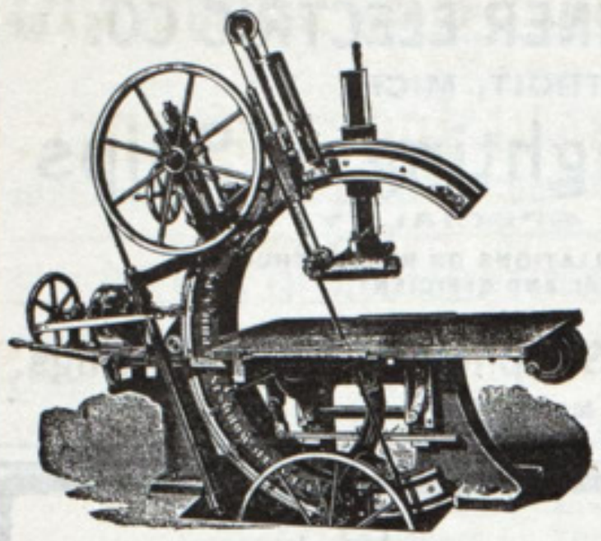
VOL. XXIV. CLEVELAND, O., SEPTEMBER 26, 1901. No. 13.



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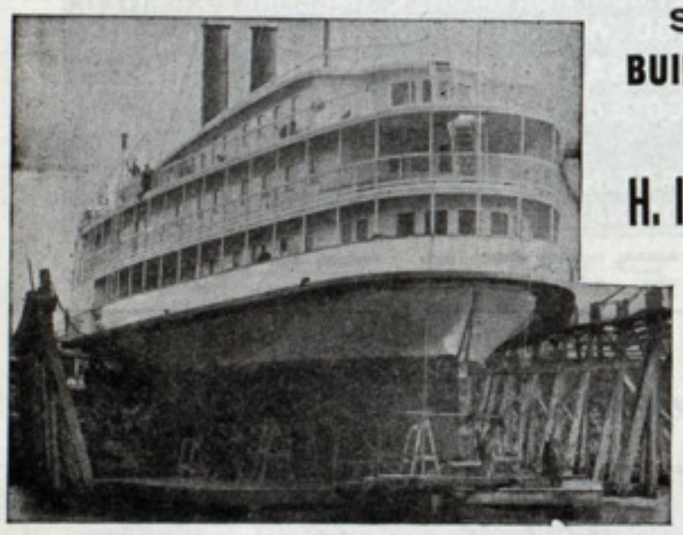

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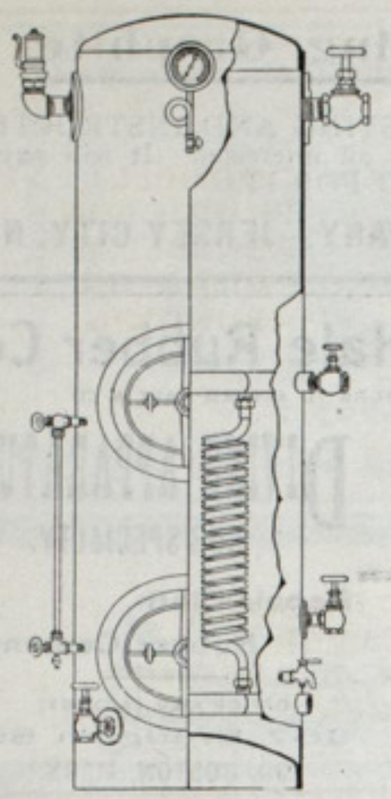

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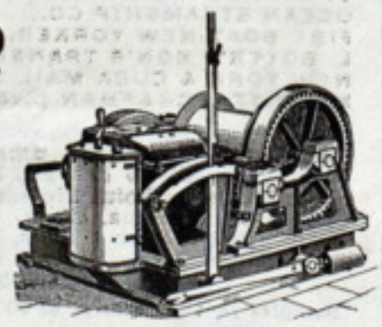

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